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Searchlight Section . . . 56-59
Engineers' Directory . . 54, 55
Alphabetical Index 88

Electrical World

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Vol. 93, No. 25 **June 22, 1929** *Pages 1271-1316*

In This Issue

Surge vs. Impulse Tests for Transformers 1275

By V. M. MONTSINGER *and* J. F. PETERS
General Electric Company and Westinghouse Electric & Manufacturing Company, Respectively

Preparation of international standards compels decision of whether American or European practice should prevail or whether each country should maintain separate methods.

An Electrical Theater 1282

By H. W. STEINHOFF
Consulting Engineer Stanley Company of America

Mastbaum Theater has latest developments in electrical equipment. 2,400-kva. substation, 400 kw. of lighting. Dynamic public address system. Five channel broadcasting. Usher signal system. Nine stage and orchestra lifts.

New Era in Industry Demands Men of Foresight, Decision, Action . . 1289

By GERARD SWOPE
President General Electric Company

Some Phases of Depreciation and Amortization . . 1291

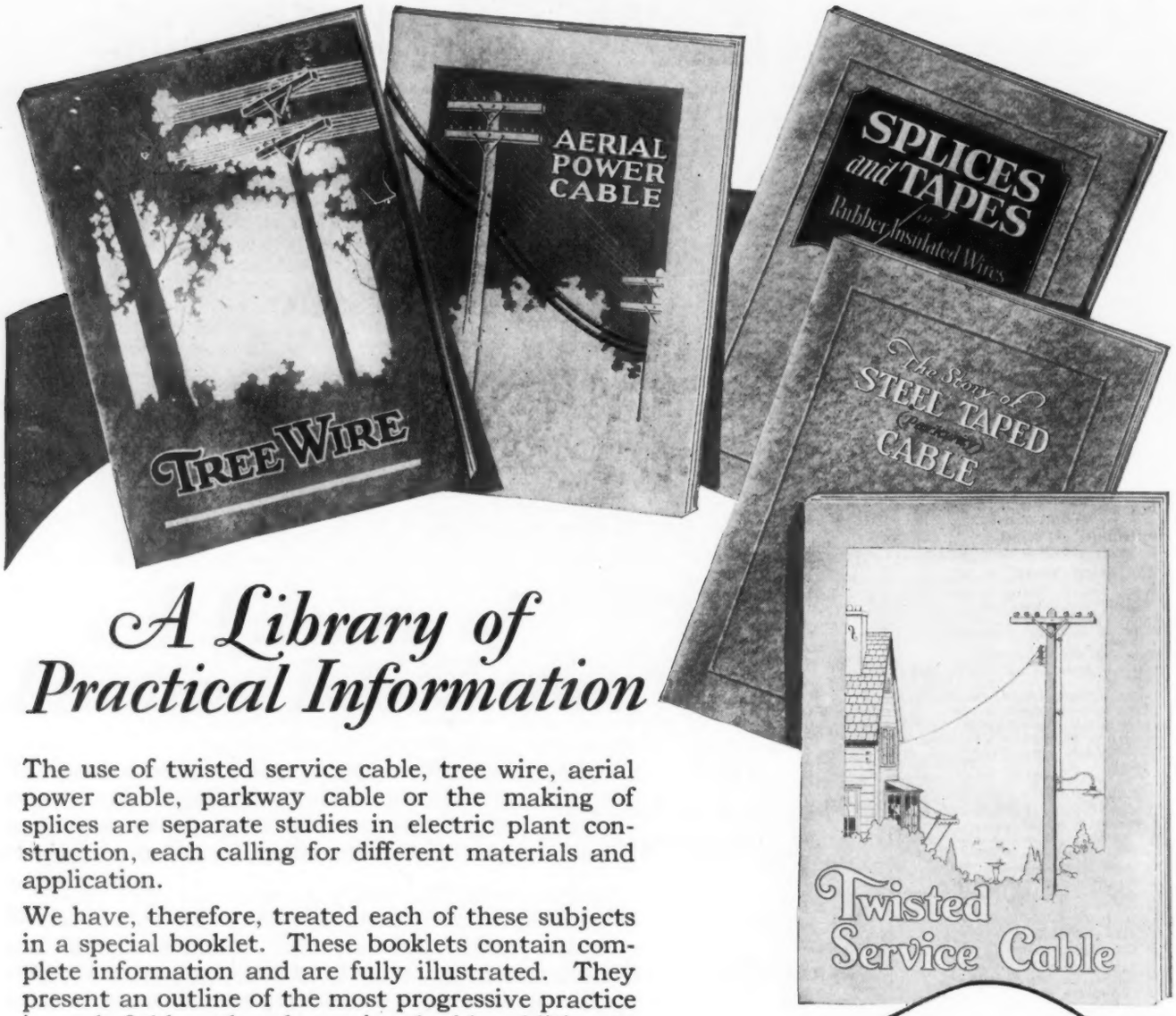
By JUSTIN H. HAYNES
Valuation Engineer Lloyd-Thomas Company

Problem of determining economic life of equipment discussed, also methods of computing vestance.

Editorials 1271
Letters from Our Readers . . . 1295
Digest of Electrical Literature. 1296
Book Reviews 1297
News of the Industry 1298
Financial and Statistical 1308

Short Practical Items:

Out-Moding the Pole Trailer; Steel Poles Prove Economical for Rural Distribution; High-Speed Excitation Tests; Widespread System Centralizes Meter Activity; Determining Voltage Drop in Reactive Feeders; Supervisory Control for Industrial Substation; Diameter of Cable for Various Sizes and Kinds of Duct; Synchronous Motor Releases Capacity in Lumber Mill; College Offers Personnel Service to Industries; Electric Heat Increases Poultry Production; Why Sign Maintenance Pays; New Shop Lighting Saves Money for Servel; Helpful Data for Electrifying Heating and Ventilating Systems.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Volume 93 — *New York, Saturday, June 22, 1929* — Number 25

A Pioneer of Light

LAST Saturday night while the Falls of Niagara scintillated beneath a lighting scheme that, in order to mark the second step in the semi-centennial jubilee, probably eclipsed in splendor anything of the kind ever attempted before, Charles F. Brush, in the city of Cleveland, across Lake Erie, lay breathing his last. Brush, two years younger than Edison, was in a sense even more a pioneer of electric lighting than the hero of the jubilee—like himself born in Ohio—for, while today's incandescent lighting derives from Edison, the prior system of arc lighting, which for so many years reigned supreme on the streets of American and foreign cities and is even yet not entirely superseded, owed its successful development in great measure to Brush.

The arc-lighting system will probably in time be only a remembrance, but it will be one that will linger long in the minds of those who as youths or children saw the first spluttering lamps shed their brilliant rays over street crossings or in store entrances and who also saw in the novel illumination the doom of the outdoor gas-lighting systems—"die-hards" though these have proved. The sight, first glimpsed, was to the eye what the telephonic transmission of speech, first heard, was to the ear—the harbinger of another age. Nothing had rivaled them as newborn sensations since the steam-driven locomotive hurtled into the complacence of a previous generation; nothing rivaled them again till, in a later one, Wilbur and Orville Wright cleaved the air at Kitty Hawk.

But the fame of Charles F. Brush will not die with the arc light. His contributions to the electrical art, mentioned on another page, have been lasting and important. His long life was full of honorable activity until its very close. He made his mark in the business world as well as in the world of science and invention. He received high honors at home and abroad. Among his last actions was the generous endowment of an organization "for the betterment of the human race." As an American poet said of another humanitarian: "A cheer! Be that his requiem."

* * * *

The Power House Beautiful

WHILE some executives are demanding lower cost per kilowatt installed in power houses, the same executives or others are beginning to demand better-looking power houses, with monumental architecture, extending even to the treatment of stacks, combined with beautiful interiors. Since beautiful architecture, like many other beautiful things, is expensive, it would seem offhand that the station designer would find himself between Scylla and Charybdis or between the devil and the deep sea.

Yet the case is not so hopeless as it would seem to be. A tiled interior will often be found a good investment in the long run, saving the expense of annual painting and floor refinishing. A competent architect, moreover, can make the exterior of a building look much better without spending a great deal of extra money by better treatment of horizontal and vertical lines. But it cannot be expected that as much space can be allowed for architectural treatment of a power house as is employed on skyscrapers, where the law frequently requires setbacks. Although at this particular period of curtailment of expenditures it may not be possible to obtain any considerable appropriation for architectural beauty, it should be possible in every case to obtain a sufficient amount to pay the fee of a competent architect. The ideal architect will be both a dreamer and a practical man and will know how to beautify a building by a stroke of the pencil.

* * * *

Those Naughty Professors

RECENT headlines in the newspapers based on Washington dispatches read "Professors Paid by Power Trust." Data submitted to the Federal Trade Commission by the National Electric Light Association show that forty-three college professors received approximately $46,000 in the period from 1921 to 1928. Of this total $32,959 was for services and $12,872 was for reimbursement for expenses. Thus, by innuendo, some of the ablest professors in the country are now tainted—they were bought up for an average sum of about $1,000.

Such episodes are ridiculous, yet they have a serious aspect because they give an insight into the public mind. Once it becomes suspicious, it will believe any rumor and any inference. Ordinary common sense shows that professorial and industrial interrelationships should be encouraged for the benefit both of industry and of the schools. It is significant that one well acquainted with the colleges commented as follows: "Those professors are the ablest men in educational circles. They are alert, ambitious, anxious to vitalize their work and to help raise the standards of industry. Instead of relaxing in their cloistered chairs, they get out and study the needs of industry, they help industry by the application of their specialized talents, and they bring back to their classrooms a fresh point of view and many timely research problems. They are independent and aggressive thinkers. I wish the colleges had more of them."

That is the true situation. All industry groups know the effective work Dean Madden has done in developing educational courses for accountants. Professors Allen, Potter and Christie have contributed greatly to the work of the prime movers and hydraulic power committees of the N.E.L.A., through which work higher economy and lower costs in energy generation have been attained. Professor Knowlton has done notable work on safety codes and in the development of the principles of inductive co-ordination. Another group has co-operated in

rural service development, another in economic educational work, and still others have carried on vital economic and engineering researches.

These professors, pilloried by newspaper innuendo, are active in their professional societies; they are distinguished as educators; they are the type the colleges need and industry needs. For paltry sums made necessary by the limited salaries and limited funds of the colleges they have given largely of their time and talents to build up the industry and their professorial efficiency. They deserve medals and not insinuating newspaper headlines.

* * * *

Celebrating "Light's Golden Jubilee"

AS PLANS progress for the national expression of accumulated gratitude to Thomas A. Edison through local, community celebrations of "Light's Golden Jubilee," several factors become increasingly evident. In making preliminary organizational plans it will have to be recognized that, however far in the background utility men may remain as regards the distribution of credit for staging the celebration in their community, they must be exceedingly active in the actual leadership and the hard work of making it a success. Local merchants are more than likely to be apathetic and reluctant to move until they learn what the other fellow is going to do. Expense is in all probability a ruling item, and if the celebration is to be properly carried out, the co-operation of the electric light and power company will have to be whole-hearted and highly tangible. Basically, it is light, more light and still more light that should express the jubilee spirit, and pageantry, parades or fireworks are not necessarily to be emphasized.

The first local celebration of Light's Golden Jubilee, following the introductory work at Atlantic City during the N.E.L.A. convention, took place at Niagara Falls last week, and it was an exhibition hard to beat. But it would be both impossible and unfair to view this splendid carnival as only an observance of the jubilee, for no less than seven local celebrations of various historical and current events were involved. Again, Niagara Falls is most unusual in local features and the character of community interests. It would be absurd to say that a city which uses so much floodlighting every night to bring out its natural beauties was not well floodlighted or that color lighting could have been developed to better advantage, since the Falls shone in 1,400,000,000 rainbowed candlepower projected from the Canadian shore. When other communities, however, less fully illuminated at all times, plan their celebrations it would be well to develop, in so far as expense budgets and local conditions permit, all elements of modern lighting to show what with the present knowledge of the art can be done. This is, after all, an important objective in the plan—to show what lighting can do.

The homes, shops, public buildings, parks, streets and highways of America should be better lighted and more attractive at the end of the celebration than before it began. Every possible form of lighting should be displayed at least once. Flood, color, decorative, changing, signs of various kinds, show window and display—all are needed. The celebration should be a record of accomplishment. Light's Golden Jubilee requires enthusiasm, planning, knowledge and, above all, hard work by at least one and probably by a number of those in the local utility company. In this respect Niagara Falls received abundant help.

Holding Companies Can Develop Tangible Proof of Value

HOLDING companies are under the fire of the Federal Trade Commission, which demands that they justify themselves. While this places them in an unjust situation, since no evidence of guilt has been presented, it does afford the companies a wonderful opportunity to show their value if they will only attempt to place tangible values on some of the benefits which called them into existence. They cannot be accused of forcing this information on the public, because it has been demanded by the public's representatives.

Although there are many complexities which prevent assigning definite values to such benefits, at least one company has prepared a brief showing tangible facts made clear in its own case. These answer only for the company concerned. Each company will have to provide its own defense; but if this one has succeeded in developing tangible values, others should be able to do as well.

Just one phase of this report gives an interesting comparison. It shows that since 1924 the company has saved its customers $44,000,000 as compared with what they would have paid had they bought the same amount of energy at the average rates of that year. But, what is more surprising, this public saving is more than twice the company's saving in production cost during that period. The paradox is established by giving actual figures—revenue and unit figures derived therefrom. Of course, the company did not give something for nothing. The growth in business accounts for the apparent discrepancy. The conclusions should be, let rightful big business flourish.

* * * *

Higher Steam Temperatures

ATTENTION has been directed from time to time to the gains that are possible from the use of higher steam temperatures. Until now American engineers have limited themselves to 750 deg. F. They have feared that the available materials for superheaters, piping and turbines would not serve satisfactorily under higher temperatures. They also feared that the phenomenon of "creep" would cause permanent deformations at high temperatures that might prove disastrous.

On the other hand, European engineers have been using higher temperatures for some time, apparently with a large measure of success. The Loeffler boiler now in use in several plants on the Continent heats the steam to temperatures ranging from 900 deg. to 1,000 deg. F., and from all accounts these boilers have operated with satisfaction.

The Detroit Edison Company is therefore entitled to congratulations from American engineers for its courage in deciding to install in its new "Delray No. 3" station a 10,000-kw., two-cylinder turbine with an accompanying superheater plant to operate at 365 pounds pressure and a temperature of 1,000 deg. F. This will be the first real high-temperature installation in America, and its installation and operation will be followed with intense interest by all power engineers. Congratulations are also due to the engineers of the British Thomson-Houston Company who have undertaken the design and construction of the turbine for this high temperature. Such initiative surely deserves commendation.

Those who have been following recent power-plant

development believe that no serious difficulties will develop in this new plant and that its successful operation will lead to a new era of higher economy in steam stations. The limitations in steam pressure have been raised by the successful operation of plants with 1,400-pound equipment, and now, as just stated, the Detroit station raises the temperature limit to 1,000 deg. F. The combination of both high pressure and high superheat must lead to station performances that will be outstanding for their low heat consumption. Both builders and buyers of this new equipment are pioneers in the development of new ranges of high station economy.

* * * *

New England Adopts Rural Service Yardstick

TO EVERY prospective rural service customer in New England has been given a means of checking the fairness of specific line extension proposals from the economic standpoint in a report of the farm power committee of the New England Council recently presented at Manchester, Vt. The test formula reads:

> The charges made by any company produce materially less than a full, fair return if the net amount received in any twelve-month period, after deducting from the total revenue received the cost of all energy used figured at 3 cents per kilowatt-hour, is not more than enough to yield 12 per cent on the total cost of the extension, including transformers, meters and services.

It is not assumed by the committee that the formula is steel-clad, because in many situations the prospect of future business to be obtained would justify charges materially less than the foregoing; but Chairman Ferguson pointed out at the council meeting that, with public opinion behind the report, any "take-it-or-leave-it" policy on the part of any power company must be thrown overboard, and that severe terms will inevitably give way to co-operation in this important field. In fact, the trend toward the abandonment of too rigorous guarantees is much in evidence, and better public relations are sure to be the outcome.

All this does not mean, of course, that line extensions can be run into the remote hinterland without regard to their financing, and the day of universal service to farms even in the East is not yet at hand. Economic facts are stubborn. Nevertheless, the cards are now face up on the table for the farmer to scrutinize, and while differences in rates and financing arrangements are bound to be found among operating companies, even in the wide circle of those identified with the council's constructive activities, the yardstick now set up enables the reasonableness of proposals for extension to be judged on a uniform basis.

This goes far to insure satisfaction even in cases where the cost of a particular extension runs higher than those interested had hoped was going to be necessary. The old comparison of prices per kilowatt-hour afforded no common denominator between different rural communities. Another bright spot in the situation is the increasing application of promotional rates to rural extensions. Low energy prices help to build loads and gradually to put extensions into the profitable class. The growth of business on farm lines in New England during the next few years is likely to be remarkably healthy, thanks in no small part to progressive companies whose practices have made them leaders in this good work.

Philadelphia Court Justifies Utility Merchandising

LAST week the Common Pleas Court in Philadelphia passed judgment on the suit of the Merchant & Evans Company vs. the Philadelphia Electric Company. At the same time it gave the answer to an argument that has been agitating the electrical industry in countless localities for years—the old issue of whether or not it is fair to other retailers for the power company to sell domestic appliances.

The court said that the charter granted to the Philadelphia utility was "for the purpose of supplying heat, light and power by electricity to the public" and that this involves supplying not "just electricity" but those appliances that make it possible to enjoy the use of electricity in the form of heat, light and power. It cited as precedent a suit against a Lancaster gas company whose grant was only "to supply gas," and yet the court concerned in that case had decided that because gas alone had no domestic value the function of the company was to supply also the appliances needed in the use of gas. This is the doctrine that has been consistently preached in these columns and for which power-company men have always contended. The outcome of the suit will naturally be received with considerable satisfaction by utility men.

There are two considerations, however, that should not be lost sight of in accepting this decision. The first is that the fact that the courts have sustained the right of the power company to sell appliances does not justify central-station merchandising practices which are uneconomic and set up an unfair competition with other dealers. If utilities in some cities had not blunderingly established unmeetable policies in their selling, probably their right to sell would never have been questioned, since their active leadership in market development brings obvious benefits to all dealers unless their methods are such as to demoralize the trade and destroy local values.

It is doubtful, in fact, whether the Philadelphia suit would itself have ever been brought had not the feelings of the electrical trade of Philadelphia been outraged a few years ago by misguided utility merchandising practices now happily corrected. In short, there is nothing in this decision, it would seem, that should give comfort to the utility or discouragement to the independent trade in any community where questionable trade practices are in dispute. It merely affirms the right—not the responsibility—of the utility to sell to the public those appliances which are essential to the enjoyment of its service.

The other consideration relates to the general complaint filed in this suit against the right of a power company to engage in the manufacture of electrical equipment. This apparently did not concern the Philadelphia Electric Company and was not passed on by the court. But it does concern certain other utility companies, and it is a matter large in the minds of the electrical manufacturing industry right now. The plaintiff cited as a precedent the action of the government in prohibiting the railroads from continuing in the coal business. The fact that no judgment was given on this issue should not be taken to indicate that it was ignored as unimportant. In other words, the court's silence does not justify the policy. It remains a subject of serious importance.

A Modern Electrified Theater

THE Mastbaum Theater has installed the latest developments in electrical applications to the theater. Stage and orchestra lifts, modern lighting, public address system, radio broadcasting and electrical usher signal system are some of the unusual features of the installation.

The view of the stage shows the 14-ft. dynamic public address horns concealed in the large fixture. The talking picture horns are mounted on an elevator shown in the raised position on the stage. Rehearsal horns are shown in the aisles ready for use by the production manager. The lighting installation alone aggregated 400 kw. and the theater is supplied by a 2,400-kva. substation.

Surge vs. Impulse Tests

for Transformers

Preparation of international standards compels decision of whether American or European practice should prevail or whether each country should maintain separate methods

By V. M. MONTSINGER and J. F. PETERS

General Electric Company and Westinghouse Electric & Manufacturing Company, Respectively

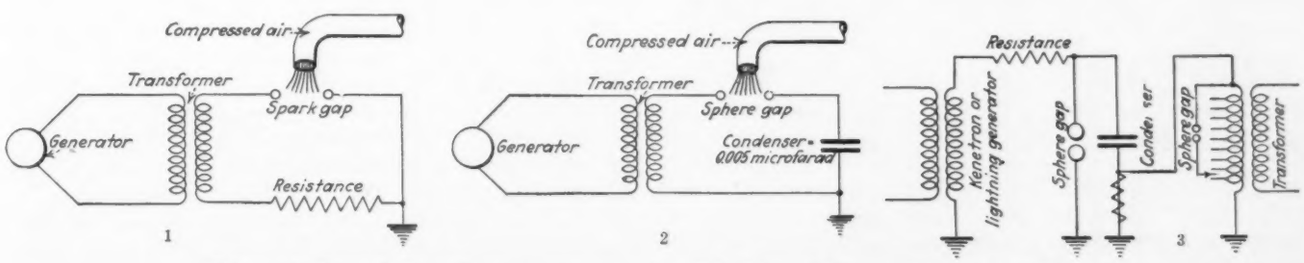
FOR several years leading European transformer manufacturers have made high-frequency tests on transformer windings as an acceptance test at the factory. They are called "surge tests," and are made for the purpose of duplicating the stresses set up within the windings under service conditions due principally to flashovers from the lines or terminals to earth and to detect weak or faulty points in the insulation. For the last three or four meetings of the International Electrotechnical Commission European engineers have urged that surge tests be incorporated in the I.E.C. rules as a factory acceptance test.

American manufacturers, however, have never been convinced that these surge tests were of any great practical value for the reason that they do not simulate the stresses set up within a transformer winding by lightning voltages, which experience in America shows are much higher and far more dangerous than the stresses caused by a line or terminal arcing to earth or by switching. However, American engineers have conducted many kinds of high-frequency tests on an experimental basis, including both impulse and surge tests, and have given careful consideration to the various possible schemes.

As a result of these studies American transformers, designed in accordance with A.I.E.E. standards, are also designed to withstand an impulse voltage simulating the maximum lightning voltages that can reach a transformer over a normally insulated line. Commercial transformers, however, are not subjected to a factory acceptance test of this kind.

Two general methods are employed by European manufacturers for making surge tests. These will be designated as methods No. 1 and No. 2. The impulse tests as used in America will be designated as method No. 3.

To show why American manufacturers do not believe it advisable to standardize these so-called surge tests it will be necessary to describe briefly the two methods proposed and to show by the results of tests the magnitude and distribution of the stresses set up within the transformer windings. They are quite willing, however, to make surge tests if a customer insists on it, although they do not feel that the results obtained justify the expense.



Figs. 1, 2 and 3—Arrangements for Making Three Types of Tests

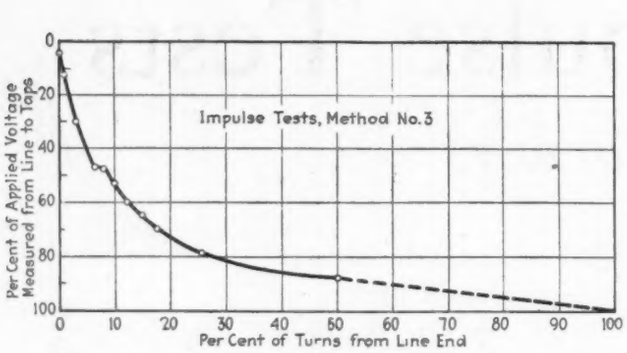
1. Surge test (method 1). 2. Surge test (method 2). 3. Impulse test (method 3).

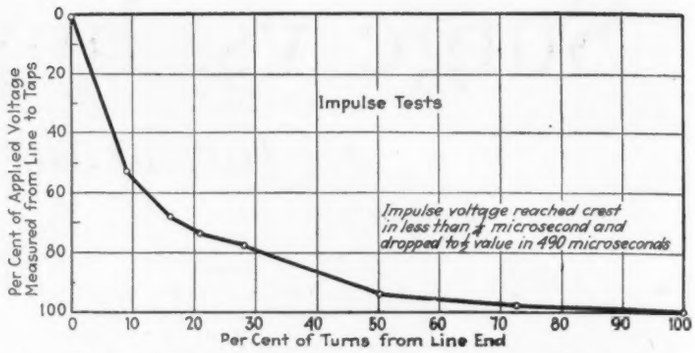
*Surge Tests, Method No. 1.**—This method consists of connecting the secondary winding of a transformer under excitation across a sphere gap and a resistance in series, as shown in Fig. 1. The steepness of the wave front is dependent on the resistance, the front sloping more and more as the resistance increases. The decay of the wave is rather slow. The stress is not as severe as that resulting from a full impulse wave as described in method No. 3. In fact, if a resistance of 10,000 ohms is used the test is harmless so far as overstressing any of the internal insulation is concerned in the average transformer.

Surge Tests, Method No. 2.†—This method uses an external condenser connected in series with a spark gap and across the secondary windings of the transformer excited from 1.1 to 1.3 times normal voltage connected as shown in Fig. 2. The wave front is very steep. The decay of the wave, however, is more or less of an oscillatory nature, depending on the amount of condenser capacity used. This test is generally more severe

*See March, 1925, Issue of the "Brown-Boveri Review."

†See V.D.E. Rules, December, 1925.




Impulse Tests
Impulse voltage reached crest in less than 1/4 microsecond and dropped to ½ value in 490 microseconds
Per Cent of Applied Voltage Measured from Line to Taps
Per Cent of Turns from Line End

Figs. 4 and 5—Initial Distribution of Stress in Transformers When Subjected to Impulse

4. Core type transformer. 5. Shell type transformer.

than method No. 1, although most of the stress is thrown across the line end coils.

The following gives the rated voltage, recommended spheres, speed of air draft and condenser capacities to be used. It will be noted that this test is limited to transformers whose rated voltage is rather low, 60 kv:

The spheres of the sphere gaps should have a diameter of not less than 50 mm.; the speed of the air draft should be about 3 m. per second. The capacity of condensers to be used varies with the rated voltage and is given in the following tabulation:

Rated Voltage, Kv.	Capacity per Phase, Mf.	Type of Condenser
2.5– 6	0.05	Cable or condenser
6–15	0.02	Cable or condenser
15–35	0.01	Cable or condenser
35–60	0.005	Condenser

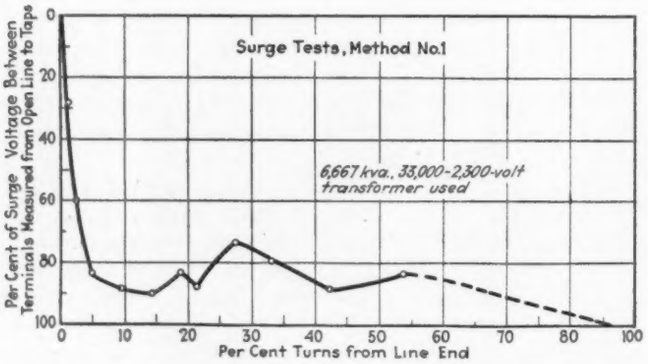
Impulse Tests, Method No. 3.—This method consists of using either a single direct-current impulse from high-voltage kenotron sets or a discharge of voltage from an alternating-current charged lightning generator. In either case, the wave front is generally very steep, though it can be made slow. The rate of decay varies, depending upon the amount of capacity used in the condensers. A diagram of this connection is shown in Fig. 3. If the wave is chopped off on the rising front, this method throws a high stress on the end turns and coils, but does not stress the middle of the windings very severely. The voltage distribution is very much the same as that obtained by the surge tests as described above. This also represents in a rough measure the stress that is imposed on a winding from a lightning wave chopped off by the arcing over of an adjacent line insulator. If the lightning voltage, however, is not sufficiently high to cause the wave to be chopped off on the rising front a full wave is thrown into the interior of the winding and stresses far in excess of those obtained from arcing grounds may be set up from any part of the winding to ground, depending upon the frequency and the constants of the circuit.‡

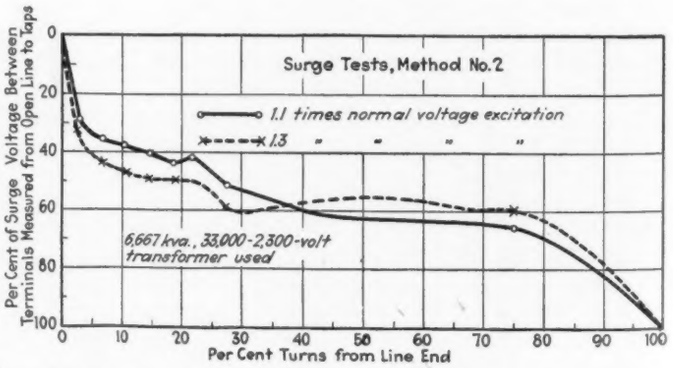
While the "impulse test" method is considered very valuable in America for determining the lightning strength of windings, it is not used for making acceptance tests. The objection to making such tests would be that if the windings were stressed near the breakdown point one is never sure that some damage has not been done without tearing down and closely examining the coils.

The object in describing the impulse method is not to propose it as a practical method for making factory tests but to show that American manufacturers have not neglected to consider the dangers of high-frequency voltages obtained in service, and that we have attacked the problem in a somewhat different manner. The present American practice is to design to meet the most severe service conditions. The vast amount of data obtained by means of the klydonograph and surge voltage recorders in America within the last two or three years shows that lightning voltages often reach values as high as ten to twelve times rated circuit voltages, whereas arcing grounds and switching surges seldom exceed about five times rated circuit voltage.

If the windings can withstand lightning surges it is felt that they are quite safe from any surges that can be imposed by terminal flashovers or continuous arcs to

‡*See "Effect of Transient Voltages on Power Transformer Design," by K. K. Palueff, presented at the A.I.E.E. winter convention, January 28-February 2, 1929.*


Surge Tests, Method No. 1
6,667 kva., 33,000-2,300-volt transformer used
Per Cent of Surge Voltage Between Terminals Measured from Open Line to Taps
Per Cent Turns from Line End


Surge Tests, Method No. 2
1.1 times normal voltage excitation
1.3 " " " "
6,667 kva., 33,000-2,300-volt transformer used
Per Cent of Surge Voltage Between Terminals Measured from Open Line to Taps
Per Cent Turns from Line End

Figs. 6 and 7—Distribution of Stress in Core-Type Transformers When Subjected to Surge Tests

(Windings connected as in Fig. 8.)

earth. This, of course, applies to operating conditions in America and may not apply to European conditions.

Comparisons of Stresses Set Up Within Transformer Windings by Both Surge and Impulse Voltages.—The difference in the two (surge and impulse) methods of generating the high-frequency voltage is that in the surge tests the internal capacitance of the transformer is mainly or partly depended upon, whereas in the impulse tests an external capacitance is used. In the first

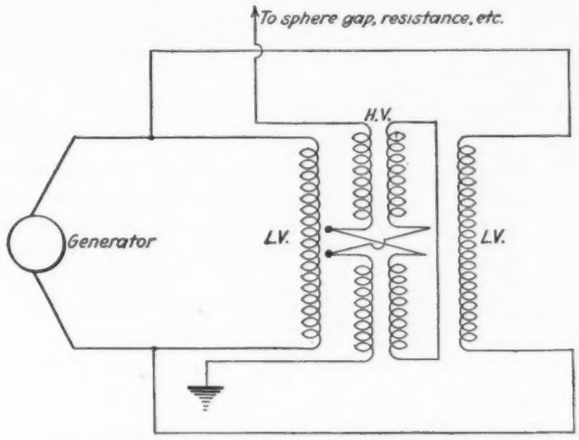


Fig. 8—Connection of Transformer Windings Used in Surge Tests

case the amount of capacitance and energy is necessarily more limited than in the latter case.

The steepness of the voltage wave can be made the same in both cases, the wave, of course, repeating itself at each alternation of the 60 cycles in the surge tests. The tail of the wave, however, is quite different, for the reason that in the surge tests the lack of capacitance and energy causes the wave to collapse immediately after reaching the crest value, but for the impulse voltage the wave can be maintained for many microseconds.

We would expect, therefore, approximately the same voltage distribution within a transformer winding when subjected to a surge test and when subjected to an impulse voltage wave cut off on the rising front by means of a sphere gap. Fig. 4 shows the voltage distribution across the windings of a typical core type transformer, subjected to an impulse voltage chopped off on the rising front of the wave. Fig. 5 shows the distribution due to an impulse in a typical shell type design. Fig. 6 shows the voltage distribution across the windings of a core type winding when subjected to method No. 1 surge test. The windings were broken up and purposely connected with re-entrant points in such a way (Fig. 8) as to be unsafe from lightning voltages under service conditions. It will be seen that no material overvoltage was built up across the re-entrant points by the surge tests and that the voltage distribution is quite similar to that shown in Figs. 4 and 5. Fig. 7 shows the voltage distribution across the same winding when subjected to method No. 2 surge test. Again no appreciable overvoltage was developed across the re-entrant points.

The following tabulation gives the approximate maximum voltage stresses imposed upon windings when subjected to the so-called surge test and when subjected to an impulse test simulating the maximum lightning voltage that can reach a transformer over a normally insulated line:

Kind of High Frequency Test	Times Normal Voltage Stress to Ground
Surge test (arcing grounds)	1.1 to 1.3
Impulse test (lightning)	10 to 12

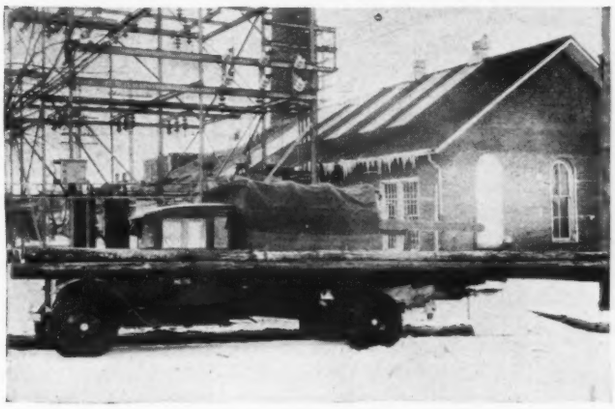
Since the stresses imposed on windings when subjected to the surge tests are far below the maximum stresses that can be imposed by lightning, it is not felt that enough would be gained in making factory surge tests to justify the expense involved. Furthermore, the surge tests apparently overstress mostly the line end coils and turns, which have sufficient extra insulation to take care of high-frequency stresses of this nature.

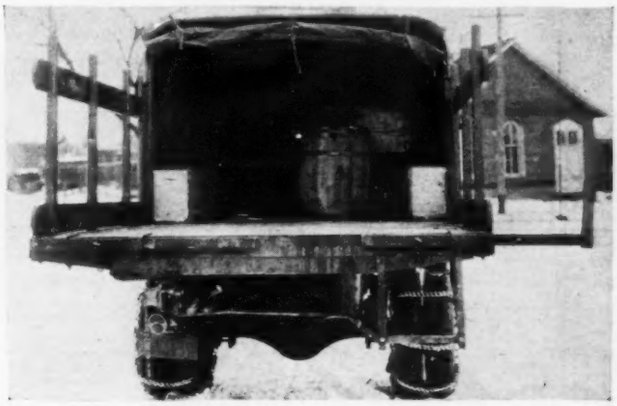
Out-Moding the Pole Trailer

By Ed Ruisch
Division Engineer Iowa Public Service Company, Cherokee, Iowa

IT HAS not yet come to pass that a crew going out to make a line extension can carry the necessary poles under their arms, but one utility at least, the Iowa Public Service Company, Sioux City, has found a way to improve the usual practice. Pole handling for small extensions in both city and rural work has always been an expensive item. Regardless of the size of the job it has usually been necessary to haul a heavy trailer behind the construction truck, often carrying only one pole. The use of a pole trailer on city streets makes it difficult to turn street corners and it is a constant traffic hazard.

Our company uses a method that can be employed to





This Truck Can Carry Six 30-Ft. Poles to the Job, if Necessary

The back view shows the left side bracket folded in and the right side one extended.

carry six 30-ft. poles on the same truck that carries the line material and the line crew. It is possible to carry all the material necessary for a 1,500-ft. rural extension in one trip, assuming the use of 250-ft. spans.

The cross-members which carry the poles are built up sections, each composed of two flat steel bars so spaced that the vertical support which holds the poles in place can fold down between them. The entire assembly can be shoved in along the bed of the truck and locked in place with pins. Various spaced holes in the cross-supports permit the device being extended part way to accommodate one pole or pike, poles and ladders.

Steel Poles Prove Economical for Rural Distribution

ONE of the most interesting aspects of the Salt River Valley Water Users' Association million-dollar rural electrification program, under which 500 miles of new line will be built and 250 miles of line rebuilt completely to electrify the Salt River valley of Arizona, is the fact that steel poles are being used throughout. The ravages of termites in wood poles in this section of the country presented a real problem, and when it was found that steel poles could be secured in large quantities at a cost comparable to treated wood poles the steel naturally was given serious consideration.

The particular steel pole used is of the latticed type, the large majority being 35 ft. in length. A 35-ft. pole of this type weighs 443 lb., has a longitudinal strength of 490 lb., a transverse strength of 1,240 lb. and, although not as strong as a new wood pole, it has the distinct advantage of undiminishing strength over a long period of years. The fact that this section of Arizona is a very light loading area made possible an average pole spacing of 330 ft. with a line consisting of a four-wire, 4-kv., No. 4 hard-drawn bare copper primary and a three-wire, No. 4 hard-drawn bare copper secondary circuit. Wood crossarms will be used and no difficulty is anticipated in working the 4-kv. circuit "hot" by the use of live tools. The average cost per mile for this type of line is $1,200, which is about comparable to the cost of wood pole construction.

Under the electrification program of the Salt River Valley Water Users' Association, which will be completed this fall, 3,000 new customers will be added, about 25 per cent of whom will use electric ranges.

High-Speed Excitation Tests

OSCILLOGRAPHIC tests on a quick-response voltage regulator on a 5,385-kva. house turbo-generator in the Saginaw River station of the Consumers Power Company, Jackson, Mich., were reported to the recent A.I.E.E. regional meeting in Cincinnati in a paper by E. J. Burnham, J. R. North and I. R. Dohr. An extensive series of tests was first conducted on the regulating equipment to tune it up under actual service conditions. The final, or performance, tests consisted of throwing on and dropping large increments of load as indicated in the table.

Load was suddenly applied by starting one or two 400-hp. motors simultaneously at full voltage. Starting two motors simultaneously was equivalent to a momentary load of about 7,500 kva., or approximately 130 per cent generator rating at 35 per cent lagging power factor.

Outline of Tests

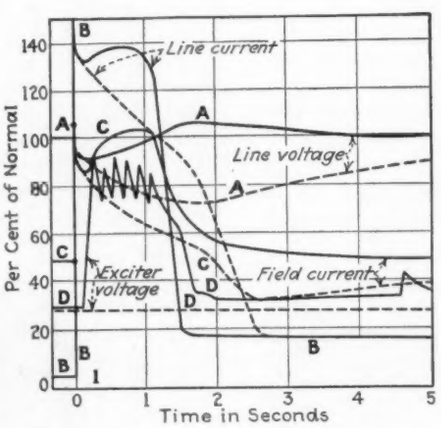
Tests	Excitation	Generator		Test Conditions
5.7	Regulated	Isolated	Carrying no load	Load applied (two motors)
6.8	Fixed	Isolated	Carrying no load	Load applied (two motors)
9	Regulated	Isolated	Carrying load	Load applied (two motors)
10	Fixed	Isolated	Carrying load	Load applied (one motor)
11	Fixed	Paralleled	Carrying load	Load dropped
12	Regulated	Paralleled	Carrying load	Load dropped

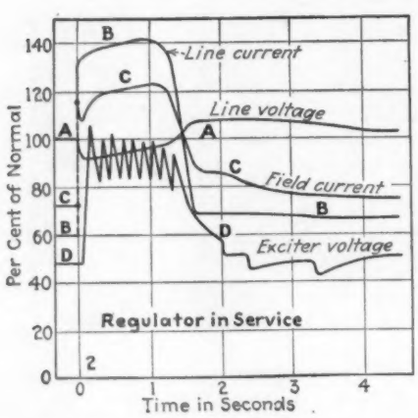
The motors came up to speed in a very short time, approximately one second with the regulator in service and two seconds with fixed excitation, and their load demand dropped rapidly to a low value as soon as they came up to speed. Load was suddenly dropped by operating the generator paralleled with the system and carrying load, then suddenly opening the generator oil circuit breaker.

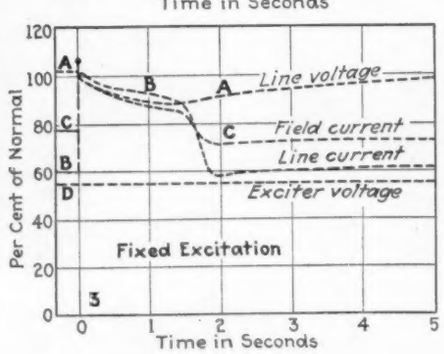
Oscillograph records were taken of generator voltage, generator armature current, generator field current, exciter voltage, exciter field current, 60-cycle timing wave.

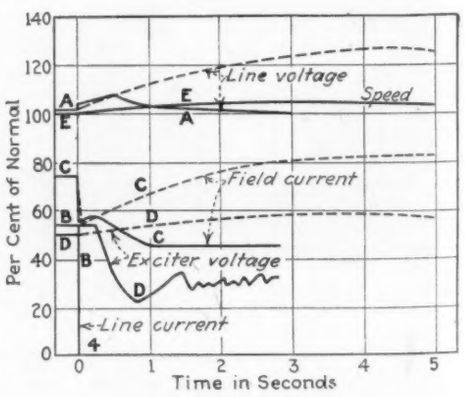
Results of Tests on Quick-Response Regulator Operation

In all tests the 100 per cent values of line voltage, *A*, are 2,500 volts; of line current, *B*, 1,245 amp.; of field current, *C*, 110 amp., and of exciter voltage, *D*, 250 volts. The solid line curves show the regulator in service and the broken lines fixed excitation. 1. Generator isolated and carrying no load, started two 400-hp. motors. 2. Generator isolated and carrying load, started two 400-hp. motors (regulator in service). 3. Generator isolated and carrying load, started two 400-hp. motors (fixed excitation). 4. Generator parallel with system and carrying load. Load dropped.









Widespread System Centralizes Meter Activity

By Dean M. Thomas
Superintendent Meter and Test Department, Binghamton Light, Heat & Power Company, Northern Pennsylvania Power Company

THREE years ago there were six locations in the territory served by the Binghamton Light, Heat & Power Company and the Northern Pennsylvania Power Company where meters were tested and records maintained. By a centralization of the department with the association of the companies many benefits accrued, including a saving of $11,270 per annum. Other benefits derived are reduced costs of operation, reduction in meter and instrument transformer stocks, reduction in testing equipment and more efficient and accurate results obtained as concentration allows the use of a higher class of employee.

Before the combination the meters cared for in each district were: A, 28,539; B, 2,769; C, 3,849; D, 5,985; E, 1,944 and F, 4,034. The distances of these districts from A are approximately 45, 45, 43, 70 and 150 miles respectively. The reorganization has established one meter department located at A in the place of six and the procedure peculiar to the rearrangement is as follows:

1. All history and test records are located at A. The system of work orders is arranged to supply the meter office with a copy of all orders. An additional cross check of meters issued from and returned to stock insures that the file is accurately maintained and that meters are not installed or removed without being properly recorded.

2. The main stock of meters is maintained at A. After laboratory test, meters are shipped in special boxes to the various districts as required. An overnight shipping schedule is possible, therefore the stock in the districts is kept at a few days' supply. Removed meters are returned to A for inspection and test before reinstallation. A weekly report is forwarded from each district to A showing meters on hand. This report also serves as a cross check on meter installation and removal orders.

It has been found possible to reduce the complete meter stock to about one-third that formerly maintained.

3. Meter installations are made from fifteen locations outside of A, each having its own stock of meters. In eleven of these locations the service man who installs and removes meters also locates and runs new services, reads meters and handles line trouble.

Local supervision of meter installations in sections D, E and F, 11,963 meters, is taken care of by one man who visits each "service man" at least once each week and more often if required. This supervisor also handles consumers' complaints and makes special meter inspections and tests. Meter installations in sections A, B and C are supervised by a man located at A, who visits the outlying districts once a week.

4. The periodic meter test schedule in the districts outside of A is maintained by dividing the territory in such a manner that a test crew enters each section but once during the schedule period and then only in three or four summer months. During the other months of the year one tester is stationed at district D and the balance of the test crew works at A.

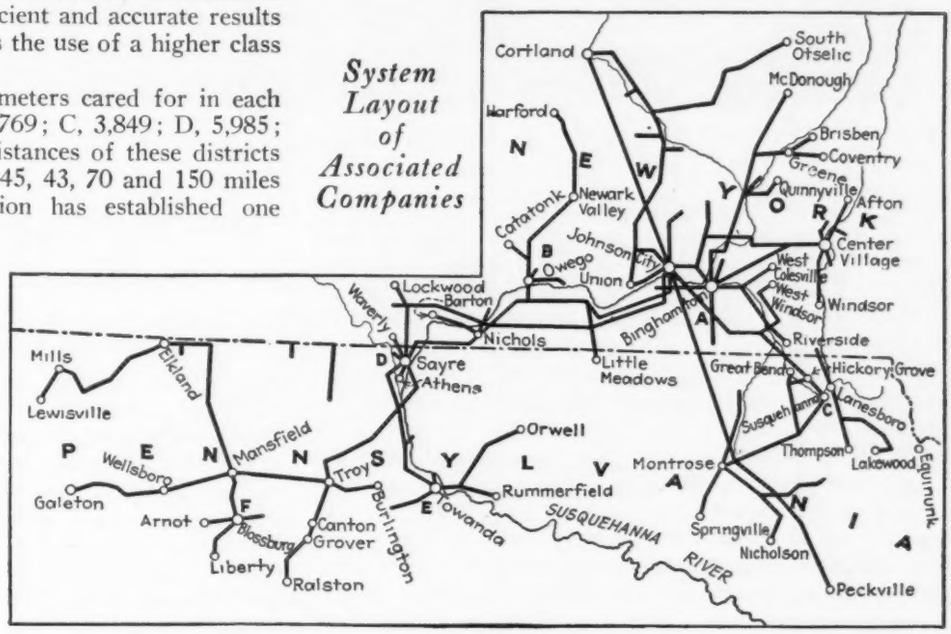
Large meters on a short schedule are grouped and the locations visited by a special tester once during the schedule period. Our experience with this plan of organization justifies the following comment:

(a) The over-all cost of operation has been lowered.

(b) The reduction in meter and instrument transformer stock represents a substantial yearly saving in interest on non-productive invested capital. This is shown in the reduction from 2,000 to 600 meters, or a saving of 1,400 meters, which, at an average of about $10 each, amounts to a reduction of $14,000 capital investment.

(c) The investment in laboratory testing equipment has been reduced to a minimum through the elimination of district testing.

Meter installation methods have been much improved



LOCATION OF SERVICE MEN, METERS INSTALLED AND POPULATION OF DISTRICTS

District	Population	Meters	District	Population	Meters
A—Binghamton	148,328	26,810	E—Towanda	13,020	1,944
Center Village	6,133	875	F—Blossburg	12,649	757
Whitney Point	9,786	854	Canton	8,089	824
B—Owego	11,574	2,433	Mansfield	9,154	812
Newark Valley	4,139	336	Galeton	4,061	458
C—Susquehanna	17,747	2,566	Troy	6,989	670
Montrose	5,596	736	Westfield	9,148	513
Nicholson	5,918	547			
D—Sayre	30,835	5,985	Totals	303,166	47,120

Methods Improved and Cost of Operation Reduced

Class of Work	Costs 1927	Costs 1928	Reduction
1. Meter history records—installation orders and records—general supervision	$12,265	$9,513	$2,752.00
2. Watt-hour meter, system and shop tests on old meters, instrument transformer tests	16,823	12,312	4,511.00
3. Watt-hour meter maintenance—repairs	6,750	4,913	1,837.00
4. Meter installations, removals, changes	11,635	9,465	2,170.00
Totals	$47,473	$36,203	$11,270.00

1928 operation was 23.8 per cent less than 1927 cost.

Meter Laboratory and Storeroom in Binghamton

through the use of uniform procedure and proper supervision. Incorrect meter connections are eliminated to a great extent and better relations established with electrical contractors who do work in more than one district.

Grouping the work of meter records and laboratory tests has made possible the use of a higher class of employee and, through the direct contact of those supervising the work, more efficient and accurate results are obtained.

In the accompanying analysis the costs for 1928 are actual expenditures. The true costs for 1927 (not shown here) have been used to determine unit costs for that year; then, to reach a true comparison, the cost shown for 1927 has been calculated on the basis of the same volume of work performed in 1928.

When Designing Steelwork for Outdoor Substations

By E. A. Van Deusen
Structural Engineer
Central Hudson Gas & Electric Corporation, Poughkeepsie, N. Y.

WATCH out for lateral deflection of girders which are carrying vertically hung disconnecting switches and choke coils, etc.

Avoid excessive deflection of girders carrying horizontally placed air breaks, disconnects, etc., otherwise it may be difficult to close them.

Watch out for reaction from closing mechanism of switches against the supporting girders or columns and make latter stiff enough to withstand it, otherwise switch blades may be thrown out of alignment.

In general, it is desirable to design girders, and other members that carry movable equipment, of exceptional rigidity in order to avoid deflection or movement detrimental to their operation. The static and dynamic loadings of this equipment must be carefully studied and provided for in the design of each element in the supporting structure.

Bracing of structure requires careful study. Due to electrical requirements it is frequently difficult to provide an ideal system of bracing. Operation of air breaks, disconnects, etc., causes objectionable sway in structure if bracing is inadequate.

Determining Voltage Drop in Reactive Feeders

By Max Kushlan*
New England Power Company, Boston, Mass.

WHEN the line reactance in an alternating-current feeder exceeds 10 per cent of the line resistance this inductive effect of the line, depending upon the size and spacing of the conductors and the frequency of the circuit, must be taken into consideration in computing the voltage drop between the feeder terminals. The method of computing the drop in voltage in a reactive feeder by the use of factors given in Tables I and II is based on the solution of the vector triangles of the line and terminal voltages. This method is approximate, since it does not take into account the effect of line capacity, but will give results correct to the nearest 0.1 of 1 per cent for 60-cycle feeders not exceeding 20 miles in length, and to the nearest 0.5 of 1 per cent for lines of the same frequency not longer than 50 miles.

The use of the tables for reactive feeders can best be demonstrated by solving a typical problem, assuming a 33-kv., three-phase, 60-cycle transmission line, 4½ miles long, feeding a 6,000-kva. load.

$$\text{The line current will be} = \frac{6{,}000{,}000}{33{,}000\sqrt{3}} = 105.0 \text{ amp.}$$

To find the line resistance drop, we will assume a No. 0000 steel core aluminum wire having a resistance of 0.445 ohm per mile.

The line resistance drop per wire will be: $0.445 \times 4.5 \times 105.0 = 210.26$ volts, referred to the neutral.

The values of line reactance and impedance drops may be obtained by looking up the line constants of a bare stranded No. 0000 steel core aluminum wire, assuming a flat spacing of 4 ft. between phases in a 60-cycle circuit. Using any reliable reactance table we will find that with this type of transmission line the reactance for a single conductor to neutral will be 0.717 ohm per mile, giving a ratio of line reactance to resistance of 1.61.

Referring to Table I, the "B" factor, or the ratio

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Table I—"C" Factors for Line Impedance Drop

$$\text{"C"} = \frac{Z}{R} = \sqrt{1 + \left(\frac{X}{R}\right)^2}$$

"B" = $\frac{X}{R}$	"C" $\sqrt{1+\left(\frac{X}{R}\right)^2}$	Diff.	Interpolated Additions of "C" for Intermediate Values of "B"								
			0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	.....	0.000	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004
0.1	1.005	0.005	0.001	0.003	0.004	0.006	0.007	0.009	0.010	0.012	0.013
0.2	1.020	0.015	0.002	0.005	0.007	0.010	0.012	0.014	0.017	0.019	0.022
0.3	1.044	0.024	0.003	0.007	0.010	0.013	0.016	0.020	0.023	0.026	0.030
0.4	1.077	0.033	0.004	0.008	0.012	0.016	0.020	0.025	0.029	0.033	0.037
0.5	1.118	0.041	0.005	0.010	0.014	0.019	0.024	0.029	0.034	0.038	0.043
0.6	1.166	0.048	0.005	0.011	0.016	0.022	0.027	0.033	0.038	0.044	0.049
0.7	1.221	0.055	0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054
0.8	1.281	0.060	0.006	0.013	0.019	0.026	0.032	0.038	0.045	0.051	0.058
0.9	1.345	0.064	0.007	0.014	0.021	0.028	0.034	0.041	0.048	0.055	0.062
1.0	1.414	0.069	0.007	0.015	0.022	0.029	0.036	0.044	0.051	0.058	0.066
1.1	1.487	0.073	0.007	0.015	0.022	0.030	0.037	0.045	0.052	0.060	0.067
1.2	1.562	0.075	0.008	0.016	0.023	0.031	0.039	0.047	0.055	0.062	0.070
1.3	1.640	0.078	0.008	0.016	0.024	0.032	0.040	0.048	0.056	0.064	0.072
1.4	1.720	0.080	0.008	0.017	0.025	0.033	0.041	0.050	0.058	0.066	0.075
1.5	1.803	0.083	0.008	0.017	0.025	0.034	0.042	0.050	0.059	0.067	0.076
1.6	1.887	0.084	0.008	0.017	0.025	0.034	0.042	0.051	0.059	0.068	0.076
1.7	1.972	0.085	0.009	0.017	0.026	0.035	0.043	0.052	0.061	0.070	0.078
1.8	2.059	0.087	0.009	0.018	0.026	0.035	0.044	0.053	0.062	0.070	0.079
1.9	2.147	0.088	0.009	0.018	0.027	0.036	0.044	0.053	0.062	0.071	0.080
2.0	2.236	0.089	0.009	0.018	0.027	0.036	0.045	0.054	0.063	0.072	0.081
2.1	2.326	0.090	0.009	0.018	0.027	0.036	0.045	0.055	0.064	0.073	0.082
2.2	2.417	0.091	0.009	0.018	0.027	0.036	0.045	0.055	0.064	0.073	0.082
2.3	2.508	0.091	0.009	0.018	0.027	0.036	0.045	0.055	0.064	0.073	0.082
2.4	2.600	0.092	0.009	0.018	0.028	0.037	0.046	0.055	0.064	0.074	0.083
2.5	2.692	0.092	0.009	0.018	0.028	0.037	0.046	0.055	0.064	0.074	0.083
2.6	2.786	0.094	0.009	0.019	0.028	0.038	0.047	0.056	0.066	0.075	0.085
2.7	2.879	0.093	0.009	0.019	0.028	0.037	0.046	0.056	0.065	0.074	0.084
2.8	2.973	0.094	0.009	0.019	0.028	0.038	0.047	0.056	0.066	0.075	0.085
2.9	3.067	0.094	0.009	0.019	0.028	0.038	0.047	0.056	0.066	0.075	0.085
3.0	3.162	0.095	0.009	0.019	0.028	0.038	0.047	0.057	0.066	0.076	0.085

$\left(\frac{X}{R}\right)$ in our case is 1.61. The line reactance drop is equal to the resistance drop, which we will designate as the "A" factor, multiplied by the "B" factor, or 210.26 × 1.61 = 338.52 volts.

The line impedance drop may be computed in a similar manner by multiplying the "A" factor by the "C" factor taken from Table I, where "C" is equal to the ratio of line impedance to resistance, equal to the square root of the sum of one plus the square of the "B" factor. For a value of "B" of 1.61, the "C" factor is equal to 1.887 + 0.008 = 1.895. The line impedance drop is equal to the product of 210.26 and 1.895, or 398.44 volts per phase to neutral. The feeder voltage drop, which is the arithmetical difference in voltage between the feeder board and the load terminal, may be computed by the aid of Table II, as the product of factor "D" and the line impedance drop. Factor "D" is determined by the ratio $\left(\frac{X}{R}\right)$, depending on the line constants, also by the power factor of the receiver circuit. In our typical feeder, the ratio of line reactance to the resistance is found to be 1.6 (to the nearest tenth), and we will assume the power factor of the combined load to be 75 per cent. From Table II we find factor "D" to be 0.958.

The feeder voltage drop may be figured as the product the three factors "A," "C" and "D," or the line impedance drop multiplied by factor "D" = 398.44 × 0.958 = 381.70 volts, referred to the neutral in each phase.

In order to convert the voltage drop referred to neutral to the same basis as the terminal voltages between phases, we have to multiply the drop of 381.70 volts by the square root of 3, resulting in a final voltage drop in the feeder of 660.34 volts. In a 33,000-volt line the per cent feeder drop is equal to $\frac{66{,}034}{33{,}000}$, or 2.00 per cent.

In cases where it is required to solve directly for the per cent voltage drop of a reactive feeder circuit, the results may be obtained directly by the use of the combined products: $\frac{100}{E} \times A \times C \times D = \frac{100}{E} \times (ILR) \times C \times D$, where I is line current in amperes, L is length of feeder in miles, R is line resisttance in one wire per mile, "C" is the factor in Table I, "D" is the factor in Table II, E is the voltage to neutral in any phase at either of the feeder terminals.

Substituting the values of our typical overhead transmission line problem in the formula given above, we have:

$$\frac{100}{33{,}000} \times 105 \times 4.5 \times 0.445 \times 1.73 \times 1.895 \times 0.958 = 2.00 \text{ per cent}$$

The direct solution of alternating-current voltage drop problems for reactive circuits may be still further simplified by tabulating the products of the factors "C" and "D" in the form of a single table, or by plotting these products as a series of curves, with the ratio of line constants represented by the factor "B" as the abscissas and the product "CD" as the ordinates, each curve plotted for a given load power factor. This method may result in a greater saving of time in finding approximate solutions, but it will involve a certain sacrifice of accuracy.

By the separate use of Tables I and II as outlined above it is possible to make a complete analysis of the circuit by determining the line resistance, reactance and impedance, also the total voltage and power losses.

Table II—"D" Factors for Feeder Voltage Drop
Volt Drop = IZ × "D"

Ratio of Line Reactance to Line Resistance $\left(\frac{X}{R}\right)$	Load Power Factor (Per Cent)												
	40	45	50	55	60	65	70	75	80	85	90	95	100
0.0	0.400	0.450	0.500	0.550	0.600	0.650	0.700	0.750	0.800	0.850	0.900	0.950	1.000
0.1	0.489	0.537	0.584	0.630	0.677	0.722	0.768	0.813	0.856	0.898	0.939	0.976	0.995
0.2	0.572	0.617	0.660	0.703	0.745	0.787	0.827	0.865	0.902	0.937	0.968	0.993	0.981
0.3	0.647	0.688	0.728	0.767	0.804	0.841	0.876	0.908	0.939	0.966	0.987	1.000	0.958
0.4	0.712	0.749	0.786	0.821	0.854	0.886	0.915	0.942	0.966	0.985	0.997	0.998	0.928
0.5	0.768	0.802	0.834	0.865	0.894	0.921	0.945	0.967	0.984	0.996	1.000	0.989	0.894
0.6	0.813	0.845	0.874	0.901	0.926	0.948	0.968	0.983	0.995	1.000	0.996	0.975	0.857
0.7	0.853	0.881	0.906	0.930	0.950	0.968	0.983	0.994	0.999	0.998	0.987	0.957	0.819
0.8	0.885	0.909	0.931	0.951	0.968	0.982	0.993	0.999	0.999	0.993	0.975	0.937	0.781
0.9	0.910	0.932	0.951	0.967	0.981	0.991	0.998	1.000	0.996	0.984	0.961	0.915	0.743
1.0	0.931	0.950	0.966	0.979	0.990	0.997	1.000	0.998	0.990	0.973	0.945	0.892	0.707
1.1	0.947	0.963	0.977	0.988	0.996	0.999	0.999	0.994	0.982	0.961	0.928	0.870	0.673
1.2	0.960	0.974	0.985	0.994	0.999	1.000	0.997	0.988	0.973	0.949	0.911	0.848	0.640
1.3	0.970	0.982	0.991	0.997	1.000	0.999	0.993	0.982	0.963	0.936	0.894	0.827	0.610
1.4	0.978	0.988	0.995	0.999	1.000	0.996	0.988	0.974	0.953	0.923	0.878	0.806	0.581
1.5	0.984	0.993	0.998	1.000	0.998	0.993	0.982	0.966	0.943	0.910	0.862	0.787	0.555
1.6	0.989	0.996	0.999	1.000	0.996	0.989	0.976	0.958	0.933	0.897	0.847	0.768	0.530
1.7	0.993	0.998	1.000	0.999	0.994	0.984	0.970	0.950	0.923	0.885	0.832	0.751	0.507
1.8	0.995	0.999	1.000	0.997	0.991	0.980	0.964	0.942	0.913	0.873	0.818	0.734	0.486
1.9	0.997	1.000	0.999	0.995	0.987	0.975	0.958	0.935	0.904	0.862	0.805	0.719	0.466
2.0	0.999	1.000	0.998	0.993	0.984	0.970	0.952	0.927	0.894	0.851	0.792	0.704	0.447
2.1	0.999	1.000	0.997	0.990	0.980	0.965	0.946	0.920	0.886	0.841	0.781	0.690	0.430
2.2	1.000	0.999	0.995	0.988	0.977	0.961	0.940	0.913	0.877	0.831	0.769	0.677	0.414
2.3	1.000	0.998	0.994	0.985	0.973	0.956	0.934	0.906	0.869	0.822	0.759	0.665	0.399
2.4	1.000	0.997	0.992	0.982	0.969	0.951	0.928	0.899	0.861	0.813	0.749	0.654	0.385
2.5	0.999	0.996	0.990	0.980	0.966	0.947	0.923	0.893	0.854	0.805	0.739	0.643	0.371
2.6	0.999	0.995	0.988	0.977	0.962	0.942	0.918	0.887	0.847	0.797	0.730	0.632	0.359
2.7	0.998	0.994	0.986	0.974	0.959	0.938	0.913	0.881	0.840	0.789	0.721	0.623	0.347
2.8	0.998	0.992	0.984	0.971	0.955	0.932	0.908	0.875	0.834	0.782	0.713	0.614	0.336
2.9	0.997	0.991	0.982	0.969	0.952	0.930	0.903	0.870	0.828	0.775	0.706	0.605	0.326
3.0	0.996	0.989	0.980	0.966	0.949	0.926	0.899	0.865	0.822	0.768	0.698	0.597	0.316

2,400-Kva. Transformer Vault and 13,200-Volt Switch Room

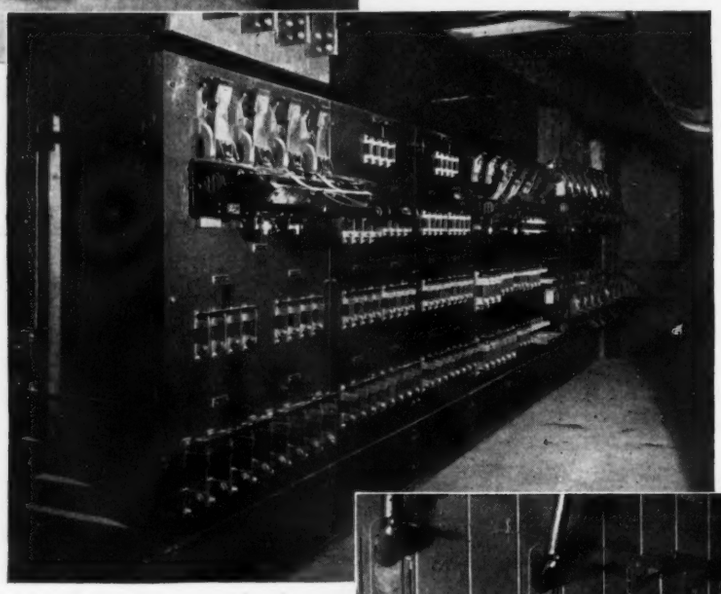
An Electrical

Mastbaum Theater has latest developments in electrical equipment. 2,400-kva. substation, 400 kw. of lighting. Dynamic public address system. Five channel broadcasting. Usher signal system. Nine stage and orchestra lifts

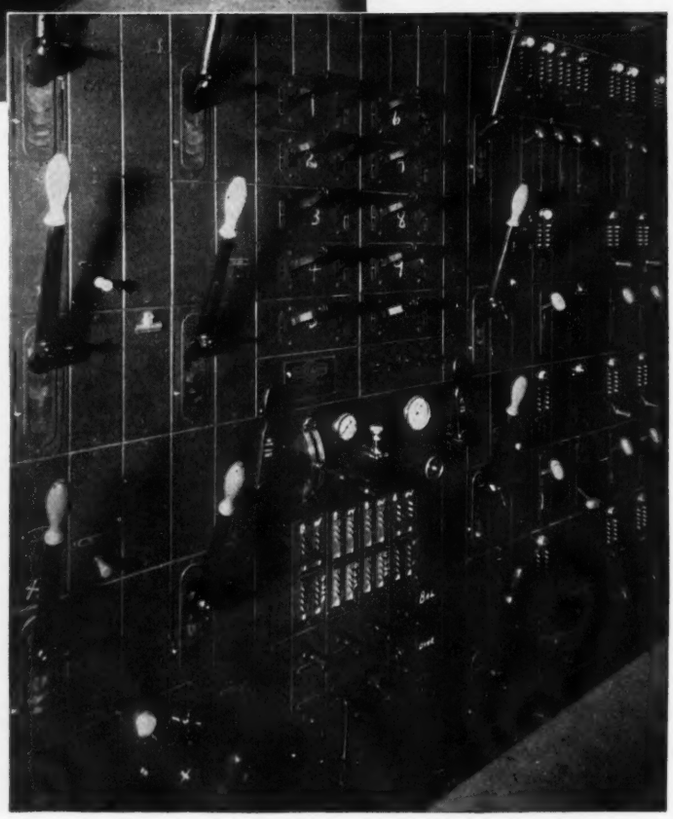
By

H. W. STEINHOFF

Consulting Engineer
Stanley Company
of America



Main Light and Power Distribution Switchboard

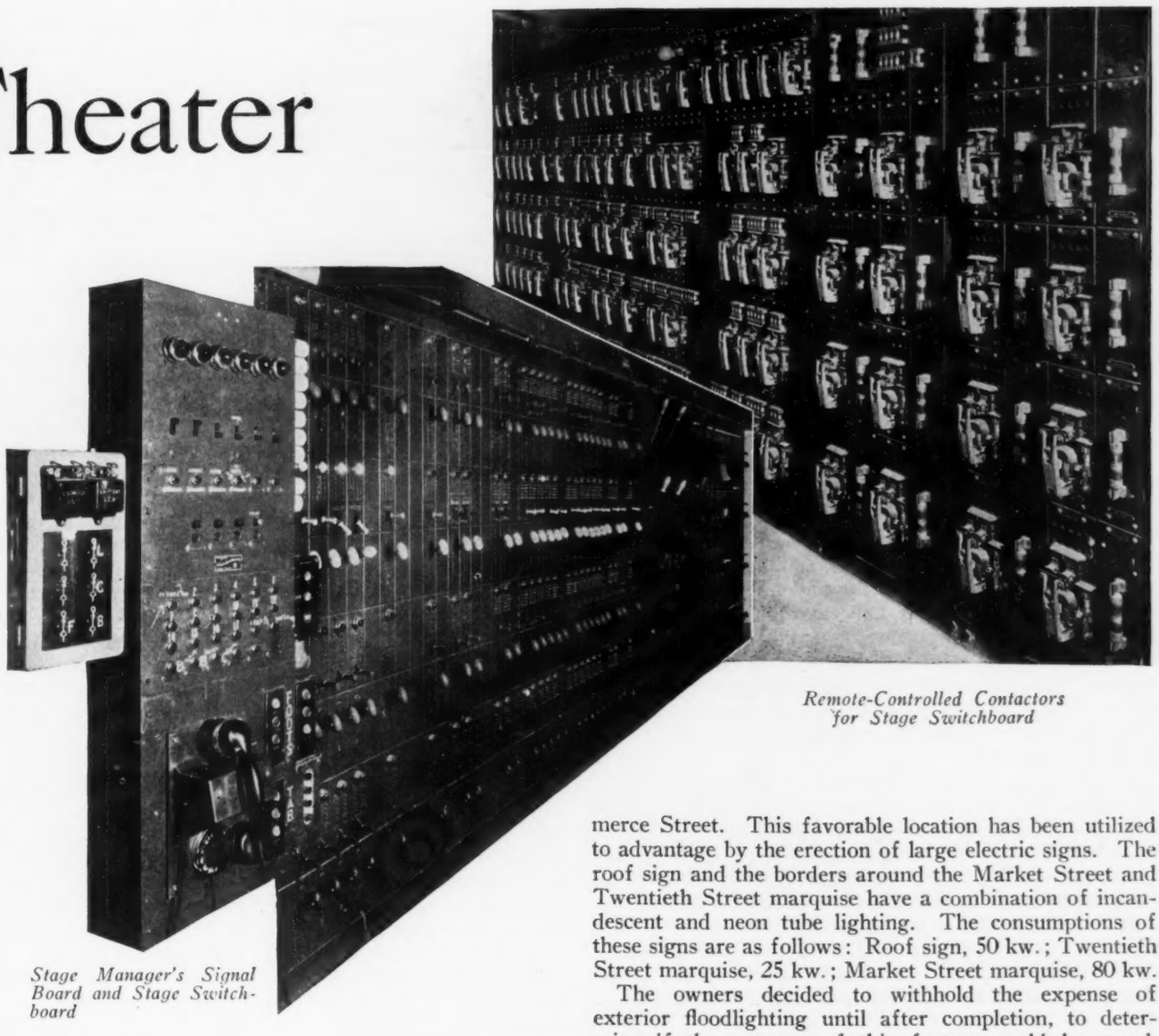


Stage Switchboard, Operator's Position

THE audience, including those electrical engineers who may be present, seldom considers the various phases of engineering which have been applied to the modern theater of today. It is the purpose of this article to describe briefly the installation of electrical equipment at the new Mastbaum Theater in Philadelphia and to point out many refinements in design not to be found in any other theater of this class.

In order to take advantage of the lowest rates offered by the Philadelphia Electric Company, it was necessary for the owners to furnish their own substation and purchase primary power. The Mastbaum substation is fed by two 13,200-volt, three-phase feeders. Each feeder is taken from a different generating station to minimize the possibility of a total outage. The two incoming feeders terminate in line switches of the truck type. These two line switches may be tied together by means of a primary bus tie oil switch, also of the truck type. During ordinary operation there is connected to each line switch a 600-kva., 220-volt, five-wire, two-phase lighting transformer and a 600-kva., 440-volt, three-wire, three-phase transformer for power. Each of the transform-

Theater



Remote-Controlled Contactors for Stage Switchboard

Stage Manager's Signal Board and Stage Switchboard

ers for light is provided with five 2½ per cent voltage taps on the primary side for voltage regulation.

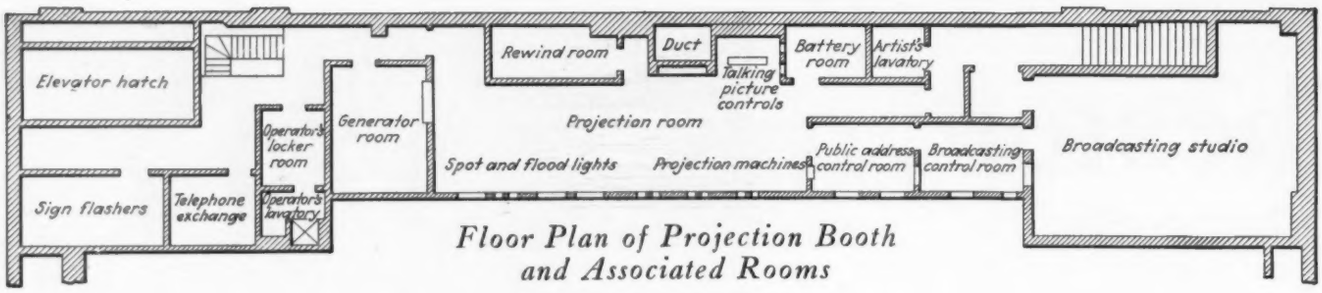
The secondaries of these transformers terminate in 2,000-amp. mechanically interlocked I.T.E. circuit breakers. Since both sets of power and lighting transformers are energized at all times, it is possible to operate the power from one bank connected to one service and take the lighting from another bank connected to the other incoming service. The spotlights and projection machines are supplied by motor-generator sets connected to the power supply, as is the organ motor, etc., hence a service interruption on one feeder, or the loss of one bank, does not constitute a total outage. For this reason the circuit breakers were not specified as of the automatic throw-over type. However, should it become necessary, the entire light and power load may be placed on the same feeder as the capacities of transformers and switching are large enough for this purpose. This arrangement constitutes a 100 per cent emergency service, with transformer banks in duplicate, which may be operated from either feeder or from the feeders in parallel.

The theater has its main entrance on Market Street and also has frontage on Twentieth Street and Commerce Street. This favorable location has been utilized to advantage by the erection of large electric signs. The roof sign and the borders around the Market Street and Twentieth Street marquise have a combination of incandescent and neon tube lighting. The consumptions of these signs are as follows: Roof sign, 50 kw.; Twentieth Street marquise, 25 kw.; Market Street marquise, 80 kw.

The owners decided to withhold the expense of exterior floodlighting until after completion, to determine if the expense of this feature could be saved. Recently, however, they decided to illuminate the entire frontage on Market Street and Twentieth Street. The architecture of a building of this type does not readily lend itself to washing the walls with light from reflectors in concealed coves. After a careful survey, it was decided to install thirty 500-watt units on the roof of the Market Street marquise to take care of this side of the building. The Twentieth Street frontage provided more of a problem. However, permission was finally obtained for the erection of ornamental pole standards across the street. There will be three of these standards, each having two ornamental brackets. Each post will carry nine 1,000-watt units. The total connected load for floodlighting will be 44 kw. This, together with the sign load, gives a total of 199 kw. of exterior lighting.

The main auditorium is illuminated principally by strip lighting concealed in coves. To obtain the various lighting effects desired, these strips are wired for three colors. There are eight chandeliers on the side walls and several smaller fixtures under the balcony. These are wired for two colors.

Concealed in the balcony rail, there are twenty-two 1,500-watt spotlights for illuminating the grand draperies on the stage. Overhead, in the main ceiling, there are concealed behind a plaster valence an additional



Floor Plan of Projection Booth and Associated Rooms

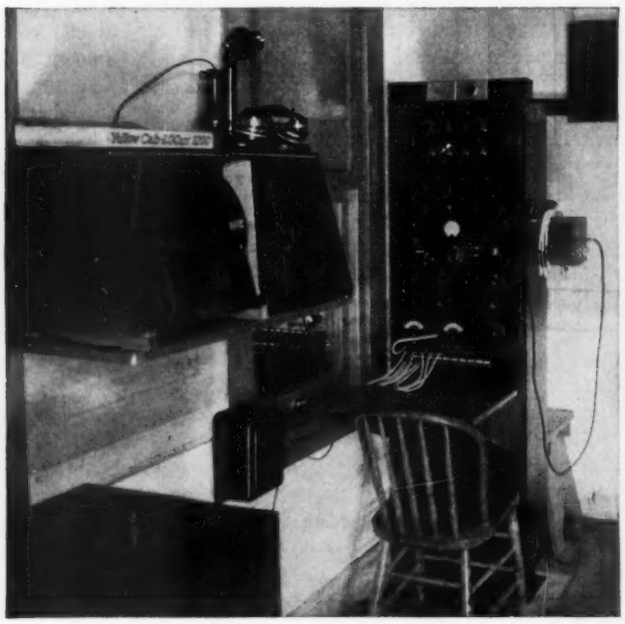
twenty-two 1,500-watt units for lighting the orchestra pit. Each of these lights is equipped with four gelatin frames. These frames may be pulled into the path of light by individual solenoids controlled from the stage switchboard. An accompanying illustration shows the banks of tumbler switches arranged in color rows beneath the two gages. In this manner it is possible to obtain any combination of colors desired with the minimum number of lamps and dimmer plates. The lighting load of the auditorium, not including that on the stage or in the lobbies, totals 203 kw.

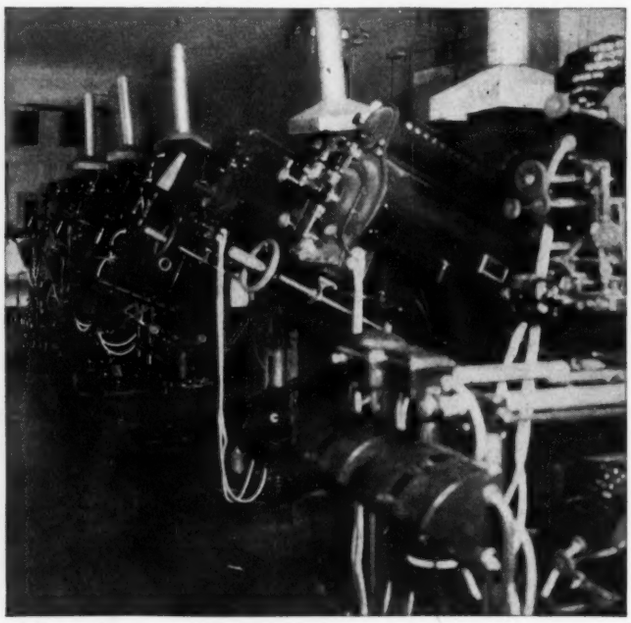
Before the type of footlights and border lights was selected tests were made in the photometric laboratories of the Electrical Testing Laboratories, New York. A study of the distribution of light and the efficiency of the reflectors of four well-known manufacturers was made. The two samples of chromium plated reflectors showed much better distribution and higher efficiency than anything previously developed, therefore it was decided to use these.

On the stage there are two sets of disappearing footlights, each 64 ft. long. These footlights have a double row of 6-in. reflectors using 150-watt lamps. Since the stage is designed for four-color lighting there is one 150-watt light of each color per running foot. The permanent stage illumination, consisting of all border lights and footlights, totals 3,000 watts per running foot. The entire stage lighting load is 181 kw., not including special effects brought in by the various shows. Although 3,000 watts per foot is a record for permanent stage illumination, there is every indication that this figure will be exceeded in future theaters.

The stage switchboard used for the control of 384 kw. of permanent lighting and any amount of portable lighting equipment which may be used is the multi-pre-set, remote-controlled type, as manufactured by the Frank Adam Electric Company. The pilot board and dimmer bank and the contactor board are shown in accompanying illustrations. With this type of switchboard, it is possible to set up in advance of any performance the various lighting combinations and arrangements required by as many as ten various scenes. To light any scene which has been properly pre-set, it is only necessary to operate the scene master. These master switches are between the master dimmer handles. Since there are 176 individual control circuits on this board, the pre-set feature not only speeds the change of lighting effects but also reduces the number of operators required.

Each lighting control circuit on the pilot board is provided with the following: A pilot light to indicate if this circuit is energized; ten small tumbler switches, each corresponding to one of the ten scene pre-sets; a manual switch to operate the circuit independently of scene sets; a dimmer handle which may be locked on either of two master drive shafts or operated independently. The two master drive shafts for each color row may be operated by the handles, or they may be connected through a clutch to a hydraulic slow-motion control. The operating handle is shown near the two pressure gages.



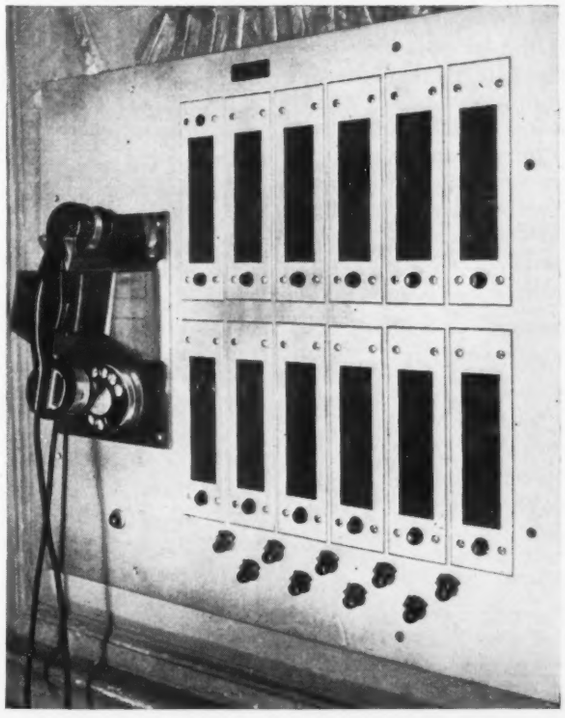


Public Address Control Panel and Projection Room

Non-synchronous turntables and record cabinet are shown at the left.

The simultaneous use of a large number of dimmer plates (there are 282 on this board) makes the smooth operation of master dimmer handles by hand very difficult. To overcome this, a system of oil-operated plungers was designed to afford uniform operation at any required speed. Compressed air from a storage reservoir is passed through a three-way valve, which is operated by the short handle shown at the left of the pressure gages in the accompanying illustration. The air acts against the oil in the operating cylinders to drive the piston in either direction and at any speed required. A study will show the complete centralization of all master controls, and it is evident that with this design a minimum amount of labor is required to operate the largest stage switchboard of this type yet constructed.

In the orchestra pit there is a large lift for the entire orchestra, a revolving lift for the console and a third lift for the two grand pianos. The 15-ft. travel of these lifts allows them to be taken from stage level to a point where they are entirely concealed from the view of the audience. When the front row of footlights, which can be raised or lowered by a motor drive, is depressed and the large lift in the orchestra pit is raised the entire ballet may work out in the center of the audience. Illumination can be obtained from the balcony rail spots when the footlights are not in use. Music can be furnished by an orchestra in a power-driven bandwagon, which can be raised from the stage basement on the rear stage lifts. If the effect of a phantom orchestra is desired, microphones can be placed on the bandwagon, and while it is being raised from the basement, the pick-up can be amplified and projected by the public address system.



Director's Panel, Usher Signal System

On the stage there are six lifts arranged to rise or descend from stage level independently of each other. The last row of three lifts can be operated in tandem to bring up from the basement a bandwagon 50 ft. long and 9 ft. deep. This bandwagon is normally kept in the basement, where it is rolled on or off the lift under its own power to save space on the stage. The front lift in the center of the stage carries the three horns used in the sound projection system. This lift is shown in its raised position in the illustration on page 1274. When talking pictures are played these horns project their sound directly through the picture sheet and aid considerably in making the spoken words and the accompanying sound effects seem less artificial.

At the stage manager's position there are located controls for the three lifts in the orchestra pit and in addition the usual visible and audible signal systems. It will be seen that the operating position of the stage switchboard is at some distance from the stage manager. This was purposely arranged so that there would be no interference in operation. The controls for the various stage lifts and the power-driven bandwagon are located at a point backstage, where the operator will have an unobstructed view of the lifts at all times.

The sound projection system at this theater has two important functions. The first is the projection of sound for synchronized motion pictures. The second is the pick-up and amplification of stage programs as a public address system. There are other functions of this equipment, such as use of portable microphone by production manager during rehearsal. The loud speakers for this work are mounted in the projection booth, back stage and for the orchestra. The orchestra rehearsal horns are portable, but the others mentioned are installed in a permanent manner. The public address system might also pick up a phantom orchestra, as mentioned before, or concealed in the broadcasting studio. If it is desired to pick up election returns or a popular prizefight the entire broadcast program may be projected over this system from leased wire service. The microphones for the public address system are located as follows: Five in the footlights, two on each side of the stage, two on the bandwagon, three in the orchestra pit, one in the announcer's room and two in the broadcasting studio for phantom work.

The public address horns, of which there are three, are mounted in a large fixture. Each horn has a 14-ft. air column and is fitted with the latest type dynamic receiver. This installation affords outstanding quality in reproduction and has another very valuable feature; during such times as the stage horns must be lowered to set or remove a scene from the stage the sound for synchronized motion pictures can be projected from the public address horns. To aid in the proper supervision of this apparatus a monitor horn is placed at the stage manager's position and a cone speaker installed in the manager's office. These are in the circuit for both sound pictures and public address work. All of the sound projection apparatus was furnished and installed by the Electrical Research Products, Inc.

Special facilities are provided for broadcasting parts of the theater program and the work in the studio. Because of expense and the difficulty in obtaining a suitable frequency for the operation of a station arrangements were made for the use of a local broadcasting plant.

In the acoustical treatment of the studio it was desirable to provide the proper acoustical background for a wide variety of programs. It is well known that if a jazz band is playing the walls of the studio should be rather hard to simulate a restaurant or a night club, while if a piano or vocal solo is being played the walls of the studio should have a high degree of sound absorption. To meet both conditions, the studio and the two control rooms were treated with $\frac{1}{4}$-in. "Celotex" on the walls and ceiling. The floors are of $\frac{1}{2}$-in. cork. This treatment is sufficiently hard for work with percussion instru-

ments. Around the walls of the studio are hung cloth curtains on track, so that the curtains can be spread around the walls to accommodate any change in program. These curtains are drawn by pulleys from the control room so that the operator can obtain any desired amount of absorption which he may find necessary by listening to the monitor.

The two control rooms are each equipped with broadcasting and public address microphones, so that these rooms may be used interchangeably for announcing purposes on either system. In this way either operator can always govern his level by listening to his monitor. The studio is also provided with a monitor so that the entertainers may hear the program being picked up in the theater. The microphones in the studio are so connected that they cannot be left in the circuit while the studio monitor is in operation. The operator, while looking into the studio, has at his left the studio control and the gain control for the monitor and the broadcasting station. To pick up the stage he merely turns in his chair so he can see the entire auditorium and stage. In this position, on his right hand there are the controls for five microphones in the footlights, two hung from one of the light bridges on the stage, three in the orchestra pit and two for the organ. These microphones are all controlled individually and are grouped in four channels, which, together with the channel for the studio, makes a total of five channels which may be mixed simultaneously.

Projection Booth

The direct current for the lamphouses in the projection booth is furnished by two 300-amp. Westinghouse motor-generator sets. The booth may also be fed by a 200-amp. generator located backstage. Because of the distance of the projection booth from the stage, it was necessary to obtain special high-intensity spotlights. The beam of light from the arc in these spotlights is so hot after it leaves the condenser that each lamp is provided with a small blower to cool the gelatin color frames.

The projection machines are equipped with a novel device for shifting the optical center of the machine when changing from movietone film to standard film. By a slight shift of the entire machine it is possible, with the use of special aperture plates, to obtain a picture of standard proportions on the screen from a square photograph on the film.

Special attention is called to the figure showing the floor plan of the projection booth and associated rooms. The location of the projection room is determined by the center line of the auditorium. The adjoining rooms are arranged to afford operators a maximum of convenience and visibility. The rewinding room is placed at the rear and slightly to the right, as it is on the right side of the projection machine that the reels are placed in the magazines. The amplifier for the sound projection system is placed at the rear and slightly to the left so that it may be observed by the operator while he is in position at the projection machine. The broadcasting studio, its control room and the public address room have double glass windows, so that each department can tell at a glance the progress of the entire program. Each of the control rooms has double glass counterweighted windows overlooking the auditorium and stage.

To provide fast, accurate intercommunicating telephone service, an Automatic Electric Company switchboard with an ultimate capacity of 100 lines was installed. At the present time there are 38 extensions on this system with one dial through trunk to the local telephone company. With this arrangement it is possible to call the police or fire department from any telephone. During certain periods of the work of the motion-picture operators it is necessary to cut off the booth telephone from ordinary callers. This is done by a switching key at the telephone. However, a special code number has been assigned to this extension and it is known only by the house manager and the stage manager. When this number, which is reserved for emergency calls only, is dialed the booth can be reached regardless of the position of the switching key.

The conspicuous location of many of the telephones in the theater, such as those in passenger elevators and at usher signal stations, required the design of a special instrument which would allow the user to talk without changing his position or facing the wall.

Usher and Miscellaneous Signal Systems

To indicate the location of available seats to the house manager, ushers, directors, elevator starter, ticket sellers and doormen an elaborate signal system has been installed by the Automatic Electric Company. At the head of each aisle there is placed a dial, together with a signal light and a concealed buzzer. When the usher desires to transmit to the lobby director the number of seats available in his section he dials this number. The pilot light at his station then lights and remains lighted until the lobby captain directs the proper number of people to this section. Having done this, the director pushes a button at the bottom of the indicating plate which resets the signal, extinguishes the user's pilot light and sounds the buzzer, thus informing the usher that the director is ready for another signal.

A totalizing board for all signals is installed. In addition to this panel, there are indicating boards at each of the balcony entrances to show the location of available seats in each section. A row of five push buttons on the totalizing board operates various colored lights at the three box offices to indicate to the ticket sellers and doormen where the available seats are located. The row of four push buttons beneath indicates to the elevator starter the landing to which patrons should be carried.

Between the projection booth, the stage, the orchestra leader, the console and the overhead spotlight station there is a system of visible and audible signals. The visible signal from any point, such as the booth to the stage, will light signal lamps at both stations. These lamps may be lighted or extinguished from either station so that one station can light the signals and the called station can extinguish the light by way of an answer. Since the two lamps are connected in series, the caller can never be in doubt as to his signal being received. The audible signals between points are used chiefly to call attention to visible signals, as it is difficult for operators to differentiate between various signal stations by using pitched buzzers. A duplicate telephone service is provided between all important stations in the theater by the use of extensions from the private branch exchange in the main office of the company.

The largest motor drive in the theater is that of 350 hp. on the compressor for the 300-ton refrigerating plant. The total cooling plant load, including fans, compressors and pumps, is 700 hp. This plant is capable of handling 8,000,000 cu.ft. of conditioned air per hour.

Two passenger elevators are provided for the convenience of patrons and one elevator serves the eight floors of dressing rooms. These elevators are all of the direct-current multi-voltage type and each car has its own group of motor-generator sets.

Supervisory Control for Industrial Substation

Remote control permits looping 66-kv. line into customer's substation to insure reliability of service

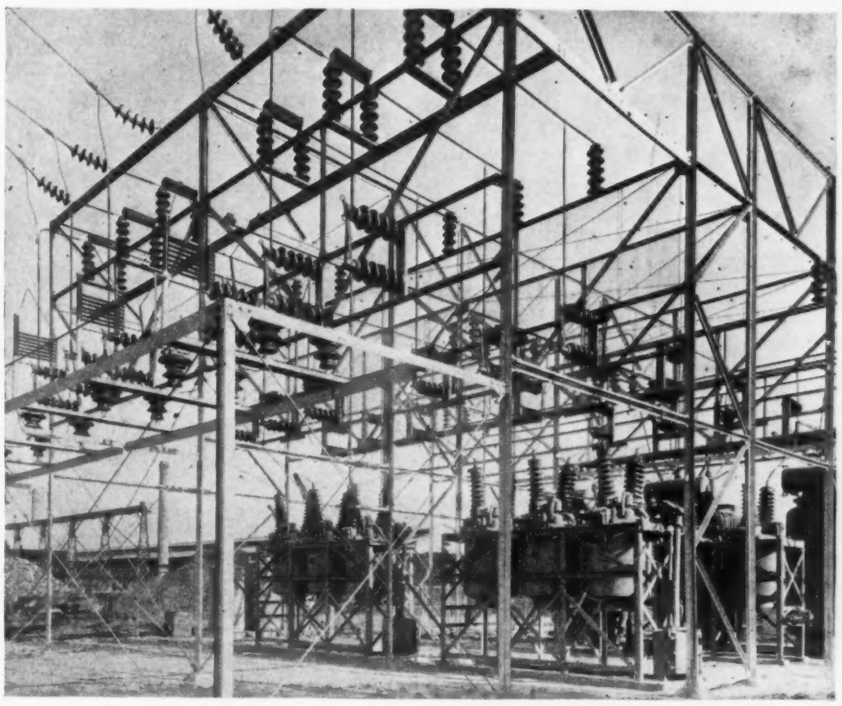
By E. V. Boekenoogen
Department of Engineering Design, Southern California Edison Company, Los Angeles

RECENT expansion of the Columbia Steel Company's plant at Torrance, Calif., required a new substation of 9,000 kva. capacity to handle the additional load. This is the first customer's substation to be equipped with a supervisory control system by the Southern California Edison Company. It is supplied by looping in a 66-kv. line, which permits feeding the customer from two sources and greatly reduces the possibility of interruption to service.

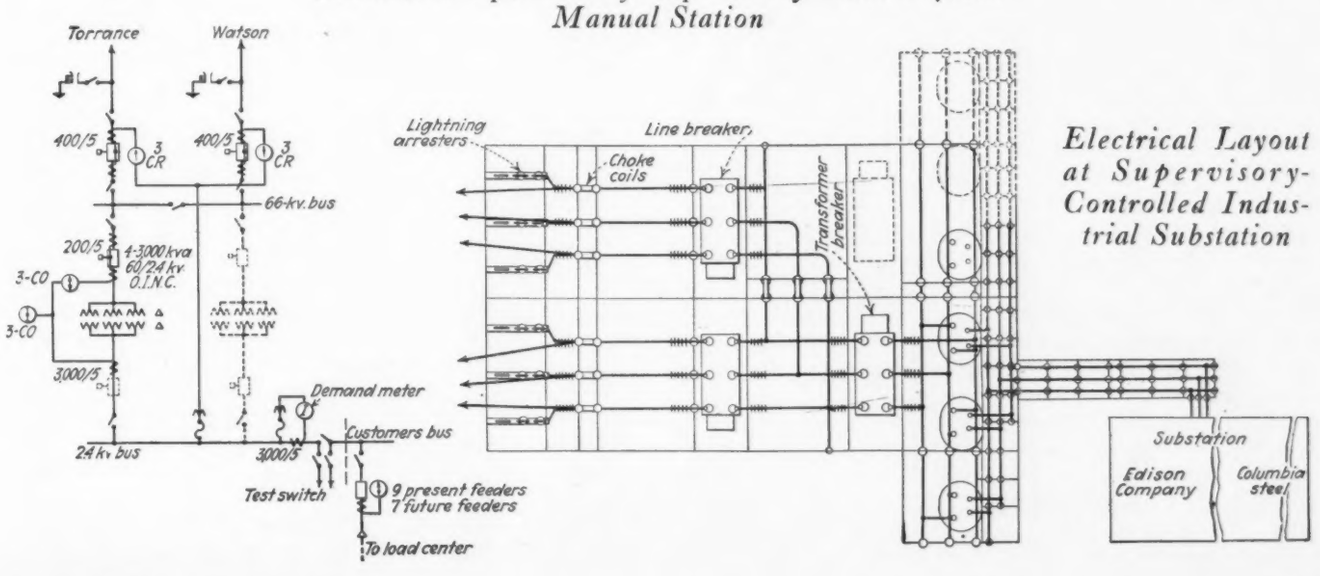
The substation is operated with selector-type supervisory control from Torrance substation, a distance of approximately 1½ miles, over a two-pair No. 14, lead-covered, 600-volt cable suspended on a 7/16-in. messenger fastened to an existing telephone crossarm on the pole line. The present equipment allows for the opening and closing of three oil circuit breakers and by red and green lamps indicates the open and closed position of these breakers. Temperature indication and alarm on the transformer bank and indication of the customer's feeder breakers also is provided. In the future the system can be extended to include a second transformer bank and three more oil circuit breakers.

The accompanying single-line diagram shows the electrical layout. A bank of four transformers (one spare) of 3,000 kva. capacity each step down from 66,000 volts to 2,400 volts. A 2,400-volt delta bus extending into the customer's substation supplies nine feeders at present, with provision for seven more. The customer's feeders are tapped off this bus through a set of disconnecting switches and oil circuit breakers and go out underground in lead-covered cable to load centers in the plant. These feeder breakers are solenoid operated and controlled from the customer's switchboard in the plant.

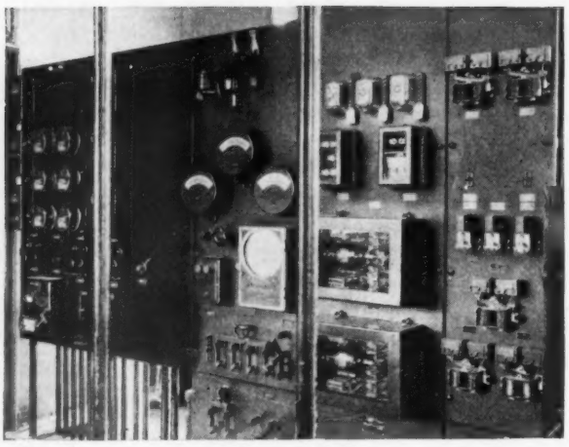
The Columbia Steel Company's feeder breakers are equipped with lockout relays so that in case of a severe short circuit on any feeder the breaker will not trip out, but will throw the duty on the Southern California Edison Company's high side transformer breaker, tripping it out on overload. This arrangement was required since the customer's breakers are not of sufficiently high interrupting capacity to handle a severe short circuit. When the lockout relays



Line and Transformer Oil Circuit Breakers at Industrial Substation Operated by Supervisory Control from Manual Station



Electrical Layout at Supervisory-Controlled Industrial Substation



Supervisory Control Relay Panels and Switchboard in Customer's Substation

function an indication and alarm are sent over the supervisory system to Torrance. After the steel company's operator has tripped the breaker on the feeder in trouble he resets the lockout relay, which reverses the indication at Torrance, indicating to the operator there that everything is clear, and he closes in the high side transformer breaker.

In using lead-covered cable for the supervisory control system no arresters were required, the only protection being the grounding of the supporting messenger cable at numerous poles. Although only three line wires are required at the present time, the fourth wire was added so that another substation in the district may be controlled in like manner in the future from Torrance.

Diameter of Cable for Various Sizes and Kinds of Duct

THE accompanying table has been prepared to cover the three types of duct indicated in the footnote and to show what may be installed in emergencies. According to C. H. Shaw, general superintendent of transmission and distribution of the New York Edison Company, who furnished this information, the figures are based on a large number of pulling tests in different cities involving different sizes of ducts now in common use. If more than one cable is to be accommodated the equivalent diameter is that of the circumscribing circle.

Synchronous Motor Releases Capacity in Lumber Mill

By H. M. Gustafson
General Electric Company, Seattle, Wash.

A RECENT installation in the plant of the Mumby Lumber & Shingle Company at Bordeaux, Wash., affords an outstanding example of the successful application of synchronous motors for power-factor improvement.

This company operates two mills, one at Bordeaux and the other at Malone, Wash., each of which cuts approximately 150,000 ft. of lumber per shift. Each mill generates its own power, the generating capacity at the Bordeaux plant being 1,875 kva. Prior to this installation the mill load was approximately 1,300 kw. at 0.73 power factor, or 1,785 kva., leaving a margin of only 90 kva. over the generator capacity.

It was recommended that a 300-hp., 1,200-r.p.m., 440-volt, 0.8-power-factor leading synchronous motor be substituted for the squirrel-cage motor drive then operating a 12x72-in. edger. The installation of this motor raised the mill power factor to 0.85 and brought the kilovolt-ampere load down to 1,530 kva., leaving a margin of 345 kva. This margin made possible a contemplated increase in mill capacity without adding generator capacity, which was impossible under the old load conditions.

The synchronous motor as an edger drive has made a name for itself by carrying, through the edger, an 8-in. cant, in which five of the edger saws were buried with the motor feed operating at high speed, a condition not ordinarily met in normal operation. The entire installation has operated very successfully.

Diameter of Cable for Various Sizes and Kinds of Ducts

(For more than one cable, diameter is that of circumscribing circle)

Nominal Diameter of Duct, Inches	Condition*	Monolithic Concrete — Actual Diameter of Duct, Inches	Monolithic Concrete — Diameter of Cable, Inches	Single Cam Tile — Actual Diameter of Duct, Inches	Single Cam Tile — Diameter of Cable, Inches	Multiple Tile — Actual Size of Duct, Inches	Multiple Tile — Diameter of Cable, Inches	Fiber Duct — Actual Diameter of Duct, Inches	Fiber Duct — Diameter of Cable, Inches	Iron Pipe — Actual Diameter of Duct, Inches	Iron Pipe — Diameter of Cable Inches
3	(1) (a)	3⅛	2⅜	3⅛	2⅞	3⅛	2⅜	3	2⅛	3	2⅛
	(b)	3⅛	2⅛	3⅛	2⅛	3⅛	2⅛	3	2⅛	3	2⅛
	(c)	3⅛	2⅛	3⅛	2⅛	3⅛	2⅛	3	2⅛	3	2⅛
	(2) (a)	3⅛	3	3⅛	3⅛	3⅛	3⅛	3	2⅜	3	2⅛
	(b)	3⅛	2⅞	3⅛	3	3⅛	3	3	2⅛	3	2⅛
	(c)	3⅛	2⅜	3⅛	2⅞	3⅛	2⅞	3	2⅛	3	2⅛
3½	(1) (a)	3⅝	3⅛	3⅝	3⅛	3⅝	3⅛	3⅛	3	3½	2⅞
	(b)	3⅝	3⅛	3⅝	3	3⅝	3	3⅛	2⅞	3½	2⅛
	(c)	3⅝	3	3⅝	2⅞	3⅝	2⅞	3⅛	2⅜	3½	2⅛
	(2) (a)	3⅝	3⅛	3⅝	3⅛	3⅝	3⅛	3⅛	3⅛	3½	3⅛
	(b)	3⅝	3⅛	3⅝	3⅛	3⅝	3⅛	3⅛	3⅛	3⅛	3
	(c)	3⅝	3⅛	3⅝	3⅛	3⅝	3⅛	3⅛	3	3⅛	2⅞
4	(1) (a)	4⅛	3⅜	4⅛	3⅜	..	..	4	3⅜	4	3⅛
	(b)	4⅛	3⅛	4⅛	3⅛	..	..	4	3⅛	4	3⅛
	(c)	4⅛	3⅛	4⅛	3⅛	..	..	4	3⅛	4	3
	(2) (a)	4⅛	3⅜	4⅛	4	..	..	4	3⅜	4	3⅛
	(b)	4⅛	3⅛	4⅛	3⅞	..	..	4	3⅛	4	3⅜
	(c)	4⅛	3⅜	4⅛	3⅛	..	..	4	3⅜	4	3⅛
5	(1) (a)	4⅞	4⅛	..	..	..	..	5	4⅛	5	4⅛
	(b)	4⅞	4	..	..	..	..	5	4⅛	5	4
	(c)	4⅞	3⅞	..	..	..	..	5	4	5	3⅞
	(2) (a)	4⅞	4⅜	..	..	..	..	5	4⅛	5	4⅜
	(b)	4⅞	4⅛	..	..	..	..	5	4⅜	5	4⅛
	(c)	4⅞	4⅛	..	..	..	..	5	4⅛	5	4⅛

*Footnote { (1) Conservative maximum size. (2) Exceptional maximum size.
(a) Good, straight section less than 300 ft. in length.
(b) Good, straight section from 300-600 ft. long.
(c) Curved section less than 300 ft. long, one or two bends of 50-250 ft. radius.

New Era in Industry

*Demands Men of Foresight, Decision, Action**

By GERARD SWOPE
President General Electric Company

GREAT and fundamental changes have come into the conduct of business and industry in recent years. The units of organization have become larger, laws and public opinion more definitely crystallized, ethics of doing business have been put on a more satisfactory basis and ownership has become more diversified—all tending to make management more and more objective and professional and to put it in the position of trustee, not only for individual owners but also for employees and the public.

Science and invention have broadened the field of industry, not only by bringing out entirely new things but by great improvements in old, which have made them available to a much larger part of the public. Progress and improvement have been made in even such a comparatively old art as steam generation, the particular field of mechanical engineering to which Stevens Institute has devoted itself so magnificently, so that today the generation of steam and its use is far more efficient than it was even ten years ago. This has contributed not only to the conservation of our natural resources but to the production of energy at lower cost and at lower selling prices, and consequently the number of users and the use thereof have been much enlarged.

So evidences of change are all about us and possibly to a small extent within us. Surely the attitude toward men and conditions of employment is different, and the men industry welcomes as leaders are different in type and training. In large part the basis of industry today is science and engineering. It is not only in new things and developments that science assists industry. It is also apparent in the reaction a body of men, devoting themselves wholeheartedly and with single purpose to improving methods, has on an entire organization. Their attitude of mind, their search for truth and their willingness to try new things, will be reflected and will act as a stimulus and inspiration to men and to management.

Business and industrial organizations become so large that they can no longer be run by one man, or group of men, by intuition. The requirements and probable use of the public must be studied and analyzed; new methods proposed must be subjected to searching tests and plans of development and exploitation carefully mapped out. In the conduct of business and industry, estimates of results are prepared and at the end of a year the actual results are compared with those predicted and, to use an engineering term, a percentage of realization determined, and dependent on this percentage realization further studies and analyses are made. When this analysis is prepared some one must make up his mind as to the right course, either to retain or to improve on these results. This calls for decision, and after decision as to the right course to follow then comes the final step, which is often the most difficult of all, to carry out the decision, which may take courage. The first two fundamentals referred to, analysis and decision as to the right solution, are distinctly the training and attitude of the engineer. Analysis, decision and courage are not the only avenues to success and happiness. Men may reach success and achieve happiness without any one or any two or all three of these characteristics, but that largely depends upon one's self and the field in which one chooses his life's work. But whatever that field may be, the greatest and most important thing is a sincere expression of one's self, in putting all that one has into the game and playing it hard. The opportunities exist and industry needs competent men.

Gerard Swope

**Abstract of an address delivered at the commencement exercises, Stevens Institute of Technology, June 15.*

College Offers Personnel Service to Industries

EVERY year industries are confronted with the problem of securing those engineering graduates who have the proper qualifications to fit in with the requirements of their organizations. Many industries send representatives to visit the engineering colleges and arrange personal interviews with the prospects, while others encourage the applicant to send a statement of his experience, training and qualifications to them. With any plan it is difficult for the company representatives to choose the men wisely.

The personnel office of the division of Engineering of Iowa State College, Ames, Iowa, has improved this condition. Securing the co-operation of the engineering student council, this office has published for the senior engineers of the nine departments a "Personnel Service Leaflet." It shows a halftone print of the student, gives his name, course and date of graduation. Further statements of training, experience and qualifications are as follows: Major interests; college and home address; personal data, including age, state of health; high school and activities; college activities and expenses earned; practical experience; date when available for employment.

Fifty sets of these leaflets were sent to leading industries early in January. These sets were inserted in leather covers furnished to the industry by the college. Each year refills will be sent to these companies and new sets to other industries that are interested. The per-

sonnel work of the engineering division of Iowa State College is under the supervision of Frank D. Paine, personnel officer, and Merrill R. Good, assistant personnel officer.

Electric Heat Increases Poultry Production

By E. D. Learned

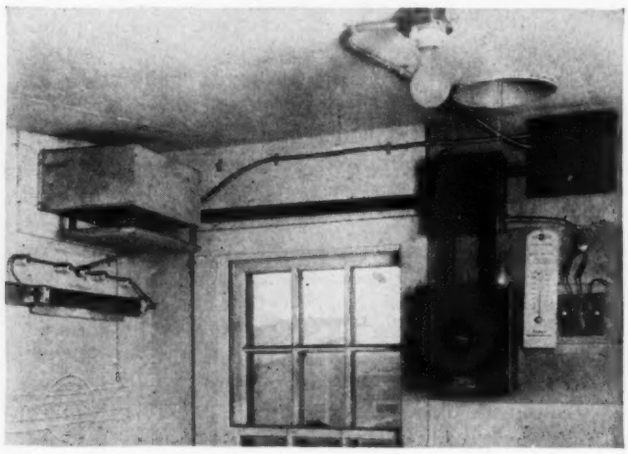
Industrial Sales Engineer Worcester Electric Light Company

"MAKE them comfortable and they will work for you," declares Byron Clark of Shrewsbury, Mass., in summarizing the advantages of a recent investment in electric heating for his poultry houses. Ten houses 10 ft. x 12 ft. x 6 ft., each sheltering ten hens and one cockerel, and three 18-ft. x 24-ft. houses, holding 30 hens and three cockerels each, are in use. The smaller houses are equipped with two 500-watt heaters each and the larger ones with four 500-watt units, making a connected heating load of 16 kw. for the 209 fowls, or about 76.5 watts per fowl. The first month's operation under electric heating, which maintained an average temperature of 45 deg. F. in midwinter weather, increased egg production 60 per cent, reduced the time of moulting 35 per cent and enabled a cheaper ration to be supplied. Many of these fowls are worth $50 apiece for breeding purposes, and the maintenance of uniform temperature forestalls losses from disease which might quickly offset the cost of energy even in the coldest months of the year. The total energy used in heating and in the lighting of these hen houses a few hours a day from January 19 to February 19 inclusive was 3,724 kw.-hr., the average rate being 3 cents per kilowatt-hour. This total of approximately 53 cents per fowl for the coldest month will of course drop off to zero for the summer season and will probably not exceed $3 per fowl per year on an average.

These chicken houses are all built on the Jamesway system, the walls and roofs being insulated and plastered and the floors double, with an air space and insulation between them. Storm windows and doors are provided, fresh air being obtained through balanced ventilators. The electric heater in each case is installed in the entrance duct, four ducts being provided in the larger house corners at the ceiling level and two diagonally opposite ducts in the smaller houses. The houses run in north and south rows and the temperature control is effected by a thermostat and General Electric No. 7006 magnetic switch installed in the first of the group of smaller houses, a similar automatic control being provided in the first of the three larger houses for their heaters. The exhaust air leaves the houses through central ventilators, two being required for each larger house and one for each of the smaller houses. No fans are required.

The birds are all Rhode Island Reds, and 100 two-year-old hens averaged 25 per cent lay before the heating installation and 43 per cent lay afterward. The moulting time was cut from the 90- to 60-day range to about 65 per cent of that period. Less heat-producing feed was also required.

The cost of the installation was about $300. Two 40-watt lamps are installed in each of the larger houses and one in each smaller one. These are turned on until 6 p.m. in midwinter for the older hens and until 8 p.m. for the pullets, seven days per week. The heaters are 110-volt General Electric units, fed from a three-wire, 110-220-volt, single-phase distribution service from a 15-kva. transformer, a fourth wire being provided for lighting service continuity when the thermostat-controlled switches are open. The general layout of the heating system was made by the industrial sales department of the Worcester company, which supplies energy to Shrewsbury in bulk for local distribution.



These Fancy Poultry Houses are Warmed to 45 Deg. F. by Electrically Heating Incoming Air

The interior view shows the air intake in upper left-hand corner with electric heater below, main switch, junction box, thermostat and magnetic switch controlling heaters in group of houses fed from this point

Why Sign Maintenance Pays

"OF 482 electric signs checked for continuous and complete usage during the hours of darkness in a middle Western city 10 were found to be disconnected and 96 not regularly operated," stated Willard C. Brown of the National Lamp Works of the General Electric Company before the 1929 New England Lighting Sales School. "The average unused wattage per sign was 100; the loss in revenue per sign per year was $8.75, or $4,222 total for the group, and there were two signs which had not been operated for four or five years. The average rate paid per kilowatt-hour was 6 cents and the average daily operating hours was four. Definite responsibility for sign maintenance placed on one man rewards all concerned."

Some Phases of Depreciation *and* Amortization

Problem of determining economic life of piece of equipment discussed, also methods of computing vestance

By JUSTIN H. HAYNES
Valuation Engineer Lloyd-Thomas Company

IT IS comparatively simple to determine the reproductive value of any piece of property but comparatively difficult to determine the sound or depreciated value. The question of depreciation or the loss in value due to time and use is of the utmost importance to the executive or accountant in charge, and at the same time is very seldom thoroughly understood. This loss in value is the largest single item of overhead expense. Profit and loss, production cost, selling price, proper insurance, etc., are vitally affected by the methods used in calculating depreciation. No matter how accurately other items of expense are calculated or to what refinement the accounting practice is carried, they lose their accuracy if the depreciation is guessed. Therefore, depreciation should only be determined by men skilled in this work, men who realize all the apparent inconsistencies, men who are able fairly accurately to reconcile them.

Depreciation is defined as "the act of lessening the value or worth: fall in value." We use the word depreciation frequently when we do not mean depreciation by this definition. When the accountant assumes a life for a certain piece of property he charges a fixed per cent per year, in order to return to the capital account the value of the property. He is not charging off depreciation, but is charging off amortization. The definition of amortization is "the process of reducing a debt through a sinking fund." These two words are synonymous only in special cases, where the estimated life, made when the property was purchased, proves later to be the correct actual life when the property was junked. Naturally, this would only be a coincidence.

Amortization is the word that should be used ordinarily in speaking of the accounting practice. Objection may be made to the above definition of amortization, as it specifies a sinking fund, while in practice the most common method is by the straight-line method. When we remember, however, that the straight-line formula is a sinking fund with zero interest we see the above definition still holds true. Amortization based on the estimated future life of any property is absolutely essential for reasons that are apparent to any business man. It is necessary for the engineer to use amortization in order to determine correctly what material, structures, etc., are needed, as compared with other alternatives. The reasons for a cost accountant to use amortization are too apparent to need specifying. Naturally, the accuracy of the amount charged to amortization is dependent on the accuracy with which the future life is estimated. This should be based on the life of the property under consideration, not on the average life of similar property. Therefore, the actual depreciation should be checked periodically and the life corrected accurately.

"When the accountant assumes a life for a certain piece of property he charges a fixed per cent per year, in order to return to the capital account the value of the property. He is not charging off depreciation, but is charging off amortization. These two words are synonymous only in special cases, where the estimated life, made when the property was purchased, proves later to be the correct actual life when the property was junked."

The question of interest on investment as a part of cost is a fundamental difference of opinion. In other words, if money is worth 6 per cent and at the end of the year a business shows that it has earned 1 per cent on its investment, one viewpoint is that it has made 1 per cent profit, the other viewpoint is that it is operating at a 5 per cent loss. The fact that part of the invested capital may be borrowed does not alter the logic of the problem. To show that we must allow the same interest rate on our sinking fund as we consider a part of cost, whether it be zero per cent or up, the following example is of interest:

*If the straight-line depreciation formula be applied to a ten-year-old cedar pole having a total natural life of twenty years, its depreciated value is 50 per cent of its cost new. Assuming the pole to cost $10 new and to have no salvage value, it would be worth $5 at the end of ten years, according to that formula. If this deduction is correct, it should be impracticable for a purchaser to use the pole during its remaining life at a less annual cost than would be incurred if he bought a new pole. Let us, therefore, compare the annual costs:

	Old Pole
Interest, 5 per cent of $5	$0.25
Depreciation, 10 per cent of $5	0.50
Total annual cost for old pole (ten years remaining)	$0.75
	New Pole
Interest, 5 per cent of $10	$0.50
Depreciation, 5 per cent of $10	0.50
Total annual cost for new pole	$1.00

Hence the old pole, purchased on a straight-line depreciation formula, can be used at a less cost per annum

**From "Mechanical and Electrical Cost Data," by Gillette & Dana.*

than a new pole. This absurd result indicates that the straight-line formula gives too low a value. The proof of absurdity is complete if we show that a sinking fund annuity applied to each price ($5 and $10) yields likewise different annual costs:

	Old Pole
Interest, 5 per cent of $5	$0.25
Depreciation annuity, 7.95 per cent of $5	0.39
Total annual cost for old pole	$0.64
	New Pole
Interest, 5 per cent of $10	$0.50
Depreciation annuity, 3.02 per cent of $10	0.30
Total annual cost for new pole	$0.80

Hence a sinking fund cannot be used to secure equal annual costs where depreciated value is derived by the straight-line formula, and in no case is it possible to use a new pole at less annual cost than an old pole, if the old pole is purchased at depreciated value calculated by the straight-line formula, therefore a rational seller would never part with a pole at a depreciated value thus calculated, unless under some sort of compulsion.

Applied to Sinking Fund Formula

Let us now apply the same sort of reasoning to the sinking fund depreciation formula, assuming the same conditions as to age and cost new of the pole. A 5 per cent sinking fund established to redeem a $10 pole in twenty years would amount to $3.80 in ten years. Hence the sinking fund depreciation formula gives $10.00-$3.80 = $6.20 as the depreciated value of the pole. Then for the old pole, we establish a sinking fund to redeem the $6.20 in the remaining ten years, which requires an annuity of 7.95 per cent.

	Old Pole
Interest, 5 per cent of $6.20	$0.31
Depreciation annuity, 7.95 per cent of $6.20	0.49
Total annual cost for old pole	$0.80
	New Pole
Interest, 5 per cent of $10	$0.50
Depreciation annuity, 3.02 per cent of $10	0.30
Total annual cost for new pole	$0.80

Whatever be the age of the old pole, a similar calculation shows a constant annual cost of $0.80. It follows, therefore, that a rational seller would part with the pole at a depreciated value, established by the sinking fund formula, provided he were put to no loss from causes incident to the sale.

So far in speaking of amortization we have considered mainly the retiring of the capital cost uniformly in the life of the property, and to a less degree the value of the property, at intermediate periods. The value of property at any particular time is primarily the function of the appraisal engineer and should be determined by depreciation or the loss in value that the property has undergone. For some of these calculations it is desirable to estimate accurately the depreciated value by means of the books of the accountant. This can be done when we have accurate cost data of all expenditures on the property. For example, we have a machine costing $1,500 new, neglecting salvage value; the operating costs on this machine are $400 the first year, $500 the second year, $600 the third year and increasing at $100 each year. It is apparent that we will soon reach the point where repairs are no longer justified, and we therefore reach the economic life of the machine. The economic life of the machine is the true life and the problem is to determine this life.

Before starting in to solve this problem we must refresh our memories as to vestance.

The Significance of Vestance

The first cost of the same type of equipment varies greatly. The life of the various types and their cost of operation offer two more intensely variable conditions. Besides all these, we must consider the different classes of equipment that are designed to serve the same purpose. Thus, for example, we have to consider the various classes of pumps, such as reciprocating, centrifugal and jet pumps, and for any one class, such as simple, duplex or triplex pumps, single or double acting, vertical or horizontal, and so forth.

With such a kaleidoscopic mass of variable factors, it would seem at first hardly possible to get a basis from which comparative values of such different classes and types may be determined. Yet such a basis may be rather readily obtained in what we call vestance, the total present cost of a permanent service.

Total vestance is made up of amortization vestance and operating vestance. Amortization vestance is that sum of money which invested at a specific interest rate and the earnings reinvested in the same fund will replace the property at the end of its life and continue to do so to infinity. The formula solving amortization vestance is the $Va = 1 - \frac{C}{T}$.

Where Va is the amortization vestance C is cost of property and T is the factor taken from a table of compound deduction for the number of years, life and interest rate decided. This table has the formula

$$T = 1 - \frac{1}{(1 - R)^n}.$$

The formula for operating vestance is of course the operating cost capitalized, $Vo = \frac{O}{R}$; Vo = operating vestance; O = operating costs per year; R = interest rate.

In solving this problem we may discard the machine at the end of any year that is advisable, and we therefore consider the total vestance separately from each consecutive year. We will find that the total vestance decreases each year for a certain time and then will begin to increase again. When total vestance of the old machine reaches a minimum the economic life of the property has been reached:

First year	Va—$26,481 Vo— 6,666	Sixth year	Va— $5,082 Vo— 10,833
Total	$33,147	Total	$15,915
Second year	Va—$13,636 Vo— 7,500	Seventh year	Va— $4,478 Vo— 11,666
Total	$21,136	Total	$16,144
Third year	Va— $9,358 Vo— 8,333	Eighth year	Va— $4,204 Vo— 12,500
Total	$17,691	Total	$16,704
Fourth year	Va— $7,214 Vo— 9,166	Ninth year	Va— $3,675 Vo— 13,333
Total	$16,380	Total	$17,008
Fifth year	Va— $5,934 Vo— 10,000	Tenth year	Va— $3,359 Vo— 14,525
Total	$15,934	Total	$17,874

This calculation shows the amount of money that could be deposited, at 6 per cent interest compounded annually, and from this fund pay all repairs and replace the machine at the end of the various lives as shown.

The total vestance reaches a minimum at the end of six years. Therefore, $15,915 would perpetually keep this machine in operation and replace it every six years. This, being the lowest amount, shows that the economic life of the machine is six years. We then have the proper basis for allocating the amortization.

Defined as "Loss of Value"

Depreciation as defined above is "loss of value." Roughly, we may say that depreciation is due to wear and tear, obsolescence, lack of utility and inadequacy. Depreciation may be due to any one or all of these.

Primarily, we are interested in depreciation in establishing the value of a piece of property at any particular time, between its purchase and the time it is junked. This becomes a totally different question from amortization, which is purely a mathematical calculation and is uniform throughout the life of the property.

Depreciation is not uniform and at first thought would be said to be without rhyme or reason. On closer study, we find that it is subject to many and varied causes, and when these are properly interpreted we find it is subject to definite laws.

Frequently from the study of the depreciation of the piece of property after a portion of its life is used we can accurately estimate the remaining life and use this figure for the purpose of amortization.

There is one excellent rule for determining depreciation, given by Gillette, which is: "The value of the second-hand machine is that value that will allow it to produce a unit of work at the same cost as a new machine." This, naturally, includes interest on investment as part of cost and is proved in the above illustration of a telephone pole. In this particular case the pole suffers depreciation for only one reason; that is time. When depreciation is caused only by time it is synonymous with amortization. A telephone pole is an excellent example of time only, causing loss of value.

Another property may yield only to wear and tear; for example, an automobile tire. Unless it is stored it will depreciate only in proportion to the number of miles it is driven. There is still another class of property that will depreciate as it is damaged, through accident or carelessness. A crowbar is an excellent example of this. There are many classes of properties that are not subject to depreciation from wear and tear, but only from obsolescence, inadequacy or lack of utility. Examples of this kind are concrete retaining walls, machine foundations and excavations.

Obsolescence is the greatest cause of depreciation and is occurring constantly In fact, progress always means that property is becoming obsolete To determine obsolescence is frequently a very difficult matter.

In the majority of cases obsolescence can be shown by the amount of money necessary to put a machine into the same condition as a new machine of the latest type. A centrifugal in a sugar factory may be obsolete due to the fact that the latest machines are equipped with ball bearings. If it costs $60 to put ball bearings in a centrifugal, then this sum measures the obsolescence of the centrifugal.

Any piece of property subject to depreciation can be kept from depreciating from wear and tear by making adequate repairs. This means that as fast as any part of the property wears out it is replaced by a new part. It, therefore, has an infinite life, as far as wear and tear is concerned. An example of this might be cited as Mount Vernon, Washington's home. It is not always economical to follow this policy, and the reason it is not economical is largely due to obsolescence. In the case of a business block that is being left behind by the march of progress, obsolescence is occurring, and for this reason the building will not be kept in first-class repair. Therefore, in many cases by measuring the wear and tear we actually measure depreciation by obsolescence.

To show what is meant, whereby a machine is kept in a high state of efficiency by making proper repairs, we may assume an ideal machine made up of the following parts:

	Cost	Replaced at End of
A	$10.00	One year
B	20.00	Two years
C	36.00	Three years
D	48.00	Twelve years
	Total cost of machine	$114.00

Yearly revenue to be set up:

For A	$10.00	For C	$12.00
For B	10.00	For D	4.00

Hence total yearly reserve to be set up $36.00

Years	Debit to Depreciation	Credit to Reserve	Credit Balance of Reserve	Sound Value of Machine	Value of Machine Plus Balance in Reserve
0	0.00	0.00	0.00	114.00	114.00
1	36.00	10.00	26.00	88.00	114.00
2	36.00	30.00	32.00	82.00	114.00
3	36.00	46.00	22.00	92.00	114.00
4	36.00	30.00	28.00	86.00	114.00
5	36.00	10.00	34.00	80.00	114.00
6	36.00	66.00	24.00	90.00	114.00
7	36.00	10.00	50.00	64.00	114.00
8	36.00	30.00	56.00	58.00	114.00
9	36.00	46.00	46.00	68.00	114.00
10	36.00	30.00	52.00	62.00	114.00
11	36.00	10.00	78.00	36.00	114.00
12	36.00	114.00	0.00	114.00	114.00

This machine is never in 100 per cent condition, except at the end of every twelfth year. However, it illustrates that with proper repairs a piece of property can have an infinite life, if the proper repairs are made.

New Shop Lighting Saves Money for Servel

By P. D. VanVliet
Vice-President A. C. Nielsen Company, Chicago, Ill.

FOLLOWING a trial installation of ten Cooper-Hewitt lamps in a small assembly department, Servel Inc., installed 100 450-watt lamps in its factory at Evansville, Ind. The main machine shop has 40 type "F" units, the sheet metal shop 36 units, the punch-press room twenty, and four are in use over a long bench on which copper condenser coils are formed.

Energy consumption varies, according to the number of hours of artificial illumination, resulting in a cost of $108.15 per thousand square feet per year for the machine shop and $112.08 for the sheet metal shop. The total annual cost for lighting the two departments is $2,452.82. Upon the most conservative estimates of increased efficiency, 5 per cent in each department, the evaluation of the gain due to more efficient lighting is $3,157 for the machine shop and $7,312.50 for the sheet metal shop.

Table of Costs and Savings—Cooper-Hewitt Lighting

Fixed Costs for 100 Lamps		
Depreciation (cost plus installation) $3,500 ÷ ten-year life		$350.00
*Average interest at 6 per cent 11/10 × $3,500 × 06/2		115.50
Allowance for tube renewals and maintenance		328.00
Allowance for cleaning		25.00
Total per year for 100 lamps		$818.50
Per lamp per year, $818.50 ÷ 100		8.19
Conditions	Machine Shop	Sheet Metal Shop
Floor area	9,000 sq.ft.	13,200 sq.ft.
Number of type F-450-watt lamps	40	36
Approximate annual hours of operation	1,435	2,925
Square feet of floor per lamp	225	367
Watts per square foot	2	1.23
Annual Operating Costs		
Fixed cost at $8.19 per lamp per year	$327.60	$294.84
Power at $0.025 per kilowatt-hour	645.75	1,184.63
Total annual cost of light	$973.35	$1,479.47

	Machine Shop	Sheet Meta Shop
Unit Operating Costs		
Per lamp per year	$24.33	$41.10
Per lamp per hour	0.0170	0.0141
Per 1,000 sq.ft. floor per year	108.15	112.08
Value of Increased Production		
Minimum estimate of production increase	5 per cent	5 per cent
Value: Machine shop, 80 men × 1,435 hours × $0.55 per hour × 0.05	$3,157.00	
Sheet metal shop, 125 men × 2,925 hours × $0.40 per hour × 0.05	.....	$7,312.50
Net Saving		
Total value of increased production in both shops		$10,469.50
Less operating costs		2,452.82
Net annual saving with 76 lamps		$8,016.68
Saving per lamp, $8,016.68 ÷ 76		105.48

Installation cost returned in less than 120 days.

*Allowing for interest earned by depreciation reserve.

The total gain is $10,469.50. The net annual saving effected by 76 lamps is $8,016.68, equivalent to $105.48 per lamp per year.

The gain due to increased efficiency under adequate lighting is equivalent to three times the first cost of the lamps and the investment is returned in four months of use.

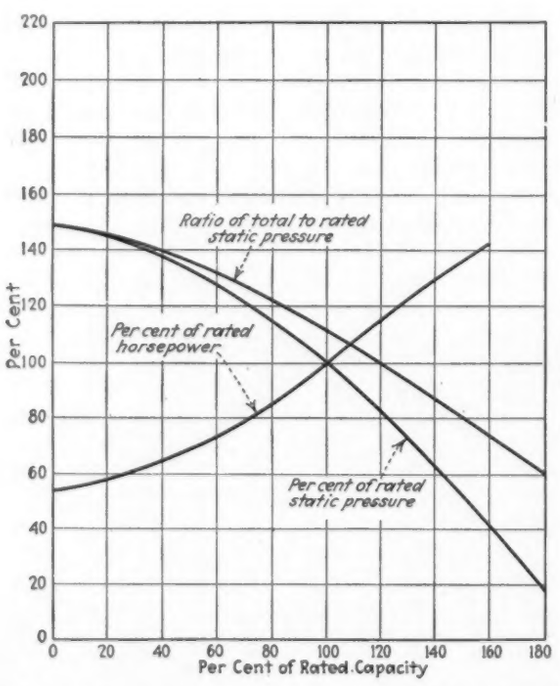
The workers prefer the present lighting system and men who have become accustomed to the new light in the sheet metal shop object strenuously when transferred to a section less effectively lighted.

The tabulation shown above summarizes the fixed and operating costs of the new lights in the machine shop and tin shop. Depreciation and average interest at 6 per cent are figured over a life of ten years. With an ample allowance for tube renewals, maintenance and cleaning the fixed charges per lamp per year amount to $8.19.

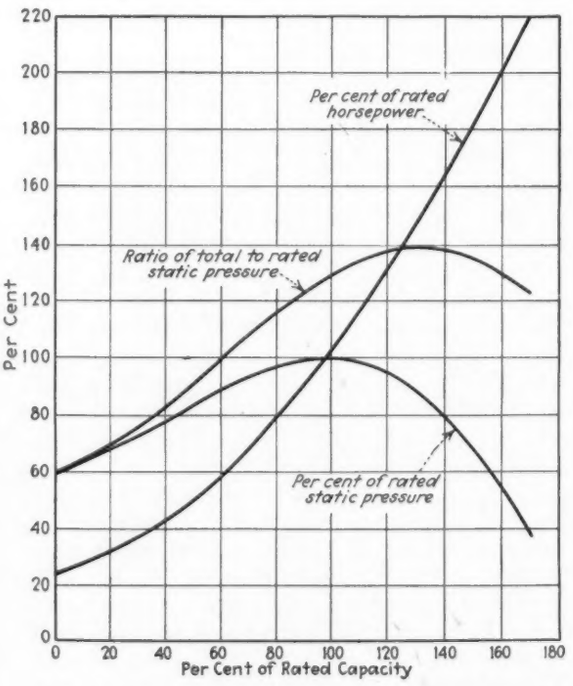
Helpful Data for Electrifying Heating and Ventilating Systems*

Cubic Feet of New Air Required per Person per Minute

	Without Humidification or Recirculation	With Humidification but Without Recirculation	With Humidification and Recirculation	Number Air Changes per Hour
Class rooms	30	20	5 to 10	.....
Assembly rooms	15 to 30	10 to 20	5 to 15	.....
Gymnasiums	30	25	15 to 20	.....
Theaters	30 to 50	20 to 30	10 to 15	.....
Hospital wards	30 to 40	20 to 30	.....	.....
Toilets	.....	.....	.....	10 to 20
Locker rooms	.....	.....	.....	5 to 10
Kitchens	.....	.....	.....	20 to 60
Dining rooms	.....	.....	.....	10 to 20
Ball rooms	.....	.....	.....	5 to 10
Work space	.....	.....	.....	5 to 10


Ratio of total to rated static pressure
Per cent of rated horsepower
Per cent of rated static pressure
Per Cent
Per Cent of Rated Capacity

Drooping Pressure Curve of Centrifugal Fans with Backward-Curved Blades


Per cent of rated horsepower
Ratio of total to rated static pressure
Per cent of rated static pressure
Per Cent
Per Cent of Rated Capacity

Rising Pressure Curve for Centrifugal Fans with Forward-Curved Blades

*Based on information obtained from the Westinghouse Electric & Manufacturing Company.

Letters from Our Readers

Characteristics of Line-Start Motors

To the Editor of the ELECTRICAL WORLD:

The article appearing in the May 4, 1929, issue of the ELECTRICAL WORLD on "Characteristics of Line-Start Motors" by G. R. Anderson is admittedly interesting and written on a very timely subject, but it appears to me to be open to severe criticism.

On page 874, column 2, paragraph 2, mention is made of the fact that a cold motor will take a higher starting current (all other conditions remaining the same) than the same motor would after it had attained full-load operating temperature, and then the suggestion was made that guarantees be based on measurements made at full-voltage and full-load temperature, the reason given being that all running performance guarantees are made on the same basis.

To me this does not appear logical. The entire point in trying to arrive at standards for starting performances is to eliminate undesirable disturbances to service arising through large voltage drops and sometimes even outages in service. Is it not a fact that the majority of motor starts are made with cold motors, or at least with motors at a temperature closer to the ambient temperature than the full-load temperature of the motor itself? If this is a fact, and it is also a fact that starting currents under these conditions are more severe, why should not the standards be worked out on the most representative basis rather than just using a basis which has been set by precedent?

In the following paragraph of the same column the statement was made that "the disturbance caused by the starting of a motor therefore depends directly on the starting current and inversely as the starting power factor." To substantiate his faith in this statement the author proposed the establishment of a standard quantity to be called "Line disturbance current," which would be obtained by dividing the starting current by the starting power factor. It is true that decreases in power factor cause increased voltage drops at the end of a circuit (all other conditions remaining the same), but it does not follow that it is an inverse proportion relationship.

A vector analysis of any given case will prove the untruth of the statement. Apply the formula $E = V + I (\cos \theta - j \sin \theta)\ V + j X)$ to the author's own reference of one motor taking 100 amp. at 70 per cent power factor and another one taking 100 amp. at 40 per cent power factor and substitute for V and X, respectively, the resistance and reactance of the circuit on which each of the motors was tested. The arithmetic value of the voltage drops (that which would be obtained by voltmeter readings directly) $E—V$, when compared, will be found to bear an entirely different ratio to each other than the inverse proportions of the two starting power factors. A vector diagram will show pictorially why this is true also. Under specially arranged conditions it would be possible to manipulate the circuit values to obtain equal ratios as mentioned, but in practice it would be merely a rare coincidence.

The above is intended only as an expressed doubt of any practical worth of the proposed "Line disturbance current" unit. It is not intended to discount the desirability of including a consideration of the motor starting power factor in the problem, because obviously there is an important effect occasioned by it. It seems to me that attempts to make the comparison of starting comparisons of motors on as simple a basis as proposed by the "Line disturbance current" method must sacrifice a good deal of accuracy for the sake of simplicity. It also seems to me that most people who are interested in making comparisons of motor performances would be perfectly capable and willing to apply a more involved method if it would be more accurate and dependable.

Why would not specifications of both the starting current and starting power factor of motors by the manufacturers suffice, if a common understanding could be created regarding their interpretation? Of course, I realize there would be a considerably large group of people who would be both unwilling and probably none too clear in applying such a method of comparison; in other words, "there's another hitch."

Concerted action should eventually bring a satisfactory solution.

N. G. ROBISCH.

Cincinnati, Ohio.

Commends Food Preservation Program and Suggests Activities

To the Editor of the ELECTRICAL WORLD:

The article on page 110 of the June 1 issue of the ELECTRICAL WORLD, entitled "N.E.L.A. Sponsors Food Preservation Program," is excellent and there is no doubt but that the activities which are to be included in this program will be far reaching in the rescults that will be obtained.

Along with the many excellent ideas and plans as outlined in the article referred to, I have a notion that a few others might profitably be included, such, for instance, as follows:

"The application of refrigeration to air conditioning in the home," which would include the automatic control of temperature and humidity and in many instances the washing of the air delivered to the interior of homes both in winter and in summer; "the use of insulation in home building," having for its object the keeping out of heat in summer and retaining heat in winter, thus lightening the load on both the heating plant and the refrigerating plant; "the necessity for sanitation and how sanitation may be improved by the proper application of refrigeration in the home"; "chemical, physical and bacteriological changes that occur in milk and cream when they have been held at temperatures above 48 deg. F. even for short periods.

The healthful benefits of conditioned air that has been properly washed and dehumidified in summer and humidified in winter should be stressed, with particular reference, perhaps, to the benefits to children of pure air such as can be made possible only by the use of air-conditioning plants.

As a famous comic section hero says, "And another thing, why not help to teach the public that cold storage commodities are not to be classified as undesirable, but rather as important and necessary and perfectly safe." Likewise, it might properly be stated that if it were not for the cold storage warehouses of the country the average family menu would be one of slight variety during the greater part of each year. Entirely too much abuse has been heaped upon the head of the cold storage man.

C. T. BAKER,
Consulting Engineer.

1729 Candler Building,
Atlanta Georgia.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Ivry Port Power Station, Paris.—A new power station has recently been constructed and set to work at Ivry Port on the Seine to supply power to the underground railway serving that city. The station at present has plant installed of the capacity of 60,000 kw., but space is provided and condensing circulation and coal handling apparatus arranged for an ultimate capacity of 130,000 kw. The turbine units develop 12,000 kw. at the most economical output, the size being settled with a view to furnishing current for the normal day load with a single unit in operation, further machines being started up for the morning and evening loads when traffic is heaviest. Coal and ash handling provisions are very complete, a monorail conveyor system constituting an essential part of such arrangements. Pulverized fuel firing is used.—*Engineering (England)*, May 10, 1929.

Outdoor Stations of Reinforced Concrete.—B. JANSEN.—If the requirements and the layout of an outdoor switching station are not too complex, the author claims that a reinforced concrete structure is less expensive than plain fabricated steel design. Three medium-sized substations of this type are now in operation in Germany and their cost was actually lower than that of equivalent steel types. An important economic feature is the negligible upkeep of the concrete construction. A more pronounced standardization of outdoor station layout would, it is stated, help greatly the promising features of reinforced concrete design.—*Elektrotechnische Zeitschrift*, April 18, 1929.

Transmission, Substations and Distribution

Experiences with Arc Suppressors.—R. BAUCH.—Similar in principle and operation to the well-known Petersen coil, the author developed some years ago a protective, arc-quenching method, which is widely used in Europe. During two days in October, 1928, a storm of tornado character raged in northern Germany, and caused great damage to transmission lines. Many of these lines of between 10 and 30 kv. were equipped with Bauch coils and had recording instruments to allow a check on "grounds" and "shorts." The author shows such records from six stations, indicating and interpreting the number of disturbances during this storm. In some instances "grounds" occurred during the height of the storm every two minutes, due to trees or limbs being blown against the lines or the falling of wooden poles. In spite of these troubles remarkably few outages occurred because the ensuing arcs were quickly stopped by the protective coils. — *Siemens Zeitschrift*, April, 1929.

Transformer Oil Testing Methods.—K. TYPKE.—Insulating oil for transformers is considered best suited for the purpose when it resists for the longest possible time the damaging influences of chemical, mechanical and temperature effects imposed upon it by the regular operation of the transformer. These various effects are well known from actual experience, but it is difficult to devise a testing method for new oil which discloses in a reasonably short testing time the suitability of the oil in respect to all of these effects. The author compiled a list of fourteen testing methods, considered standard in various countries, and subjected them to a critical examination from the chemical and operating engineers' standpoint. In view of the great variety of methods, some of which lack the backing of sufficiently long practical experience, the author hopes that the pending decision upon one or two methods, to be made by the International Electrochemical Commission, will simplify and standardize oil testing methods for the whole world. —*Elektrotechnik und Maschinenbau*, April 28, 1929.

Leningrad Substation.—C. J. WEBB. —Electrical energy from the 80,000-hp. hydro-electric station under the Volchov River, 83 miles from Leningrad, is transmitted over 220-kv. transmission lines and stepped down to 35 kv. by means of two indoor type transformers located at the Leningrad substation. As a standby a third identical transformer is provided, being so arranged with respect to the 120-kv. busbar system that by means of two electrically operated section switches it can be connected to either of the two lines. The normal input of the substation is about 70,000 kva. There is no excess voltage protection except that the neutral points of the transformers in the generating station are grounded and the high pressure neutrals of the stepdown transformers in the substation are grounded through pressure transformers. Energy at 35 kv. is transmitted to a duplicate busbar system, one-half being kept as a standby. The system has been arranged so that parallel operation between the two transformers can be effected through two sets of reactance coils, whether the normal transformers or the standby transformer is in operation. From the 35-kv. busbar system power is distributed through cables to different load centers in the Leningrad district arranged on a ring layout, where the pressure is further transformed down to 6.3 kv. From the 35-kv. busbars power is taken to a tertiary station housed in the main substation, where the pressure is also stepped down by two indoor transformers to 6.3 kv.—*Electrical Review (England)*, May 17, 1929.

Units, Measurements and Instruments

Recording of Fast Vibrations.—H. THOMA.—Various procedures have become known in late years for measuring and recording very small variations of length, down to a millionth of an inch, by the use of a movable condenser in resonance connection. The author of this article has gone a step further and applied this method to the continuous recording of vibrations of rotating machinery. The electrical oscillations are first rectified, then amplified, and finally recorded photographically with the aid of a string galvanometer. The latter can be made readily sensitive for up to 10,000 cycles per second. With this apparatus some highly interesting records have been obtained of hitherto unknown, more or less periodic, vibrations of generators, motors, water wheels, turbines, tool machinery and others, the knowledge of which may greatly benefit mechanical design.—*Zeitschrift des Vereines Deutscher Ingenieure*, May 11, 1929.

Minimum Impedance Relay. — H. PUPPIKHOFER.—A discussion of the characteristics of overcurrent, differential and no-voltage relays, showing the superiority of the impedance type of relay protection. Similar in principle to a relay developed recently by another Swiss concern, the type described comprises three distinct instruments: (1) An impedance measuring device, consisting of two moving coil elements; (2) a directional relay, and (3) a timing device. A detailed theoretical and constructive description of the apparatus and operating experience in railway service on the electrified Swiss Federal roads is given. — *Bulletin de l'Association Suisse des Electriciens*, May 7, 1929.

Heat Applications and Material Handling

Machining of Laminated Iron Cores. —F. GOLTZE.—In spite of using very accurately cutting dies, manufacturers find it sometimes necessary to machine the ends of laminated cores, such as, for example, the stators and rotors of narrow air gap motors or perhaps of butt joint transformers. The writer has investigated the influence of such machining upon the permeability and hysteresis losses in laminated structures. Microphotographs were taken, and the ohmic resistance across a bundle of laminations was measured with the following result: Resistance when laid up, 0.74 ohm; resistance after filing surface, 0.08 ohm; resistance after "*f*" with shaping machine, 0.016 ohms; resistance after grinding (hard stone), 0.0085 ohm; resistance after grinding (soft

stone), 0.007 ohm. Similar results were found after a stator was bored out. These tests show plainly the detrimental effect of subsequent machining operation on laminated core structures.—*Elektrotechnische Zeitschrift,* March 14, 1929.

Electrophysics, Electrochemistry and Batteries

Electric Storage Batteries in Three-Phase Systems.—J. BERDELLE.—The additional cost of electric storage in batteries in three-phase systems, caused by unavoidable losses in double transformation, does not necessarily defeat economical possibilities, if proper machines and the most suitable method of connection are used. The battery should be installed in the distribution lines of 10 kv. or less, so as to keep peak loads off the main station, high-voltage line and substations. Whether rotary converters or motor-generators are to be used must be decided by local circumstances. Higher efficiency and less maintenance must be weighed against overloads, better regulation and phase compensation. Two typical cases are illustrated with simplified diagrams. With rotary converters in sizes between 1,500 and 4,000 kw., over-all electric efficiencies of 61.4 per cent can readily be reached. Even with motor-generators better efficiency results than for hydraulic accumulation. Instant standby is one of the chief advantages of battery storage. Elaborate cost data are given for various hypothetical cases.—*Elektrotechnische Zeitschrift,* April 25, 1929.

A Table of Electrochemical Equivalents.—G. A. ROUSH.—The last complete table of electrochemical equivalents is that calculated by Herig, based on 1917 atomic weights. Since that time there has been a large number of revisions in atomic weights, some of them of considerable magnitude. For example, the atomic weight of aluminum has dropped about one-half of 1 per cent and that of beryllium 1 per cent; bismuth has increased ½ per cent and antimony more than 1 per cent; many others have changed to a lesser degree. This seemed sufficient justification for a new table, and the entire list was therefore recalculated on the basis of the American Chemical Society's table of 1929 atomic weights and the results presented.—*Report the American Electrochemical Society,* May, 1929.

Traction

Conductivity of Bonded Rails.—TH. MULLER.—It is greatly in the interest of alternating-current railways to confine as much of the return current to the rails as possible, because inductive interferences in nearby lines and cables can thus be greatly reduced. Measurements were made on a 22-mile long track, first without and then with electric bonds. Currents through the rail joints were determined by shunting a definite length of the rail with a thermocouple galvanometer and measuring millivolts. A standard rail (58 sq.cm.) of 10-m. length gave thus 100 millivolts when traversed by 100 amp. at 16⅔ cycles. An ordinary steel-clamped joint was found to have an average resistance of 2,000 micro-ohms, while electrically bonded joints measured 350 micro-ohms. Induced current in the lead sheath of a cable, buried near the rails, dropped 40 to 50 per cent.—*Bulletin de l'Association Suisse Des Electriciens,* April 22, 1929.

Miscellaneous

The Science of Rubber Aging.—P. DUNSHEATH.—The perishing of rubber is one of the most insistent of the problems which have occupied the rubber chemist ever since this material was first employed in industry. The characteristic features of such deterioration are well known. The rubber loses its elasticity and tensile strength, sometimes it becomes soft and tacky, but more generally it assumes a hard and resinous condition with cracks on the surface. It has long been known that the deterioration of rubber by aging was associated with oxidation. On the other hand, the destructive effects of light on rubber are well known, and while it is generally held that oxidation is the principal effect in aging, there is some evidence that light can cause failure, though to a limited extent, even in the absence of air. In any case, light accelerates the normal oxidation. The change in the rubber molecule C_{10} H_{16} through oxidation is not very clear. Various formulas have been suggested, such as C_{10} H_{16} O, C_{10} H_{16} O_2, C_{20} H_{32} O_{20}, with many others. There is some difficulty in isolating and identifying the several products of oxidation, but it is evident that the proportion of oxygen varies considerably.—*Distribution of Electricity (England).* May, 1929.

Book Reviews

Swiss Statistics

Statistik der Elektrizitätswerke der Schweiz, 1927, bearbeitet vom Starkstrominspektorat. Zürich: General-sekretariat des S.E.V. and V.S.E. 111 pages, two illustrations.

Although this is the "small edition," confined to systems with a total load of more than 500 kw. or generating plant capacity exceeding 300 kw., it accounts for all but about 3 per cent of the energy produced and 6 per cent of that distributed. As in the tabulation for 1925 the statistics go into much detail—technical, financial and commercial. Most of the 111 pages are devoted to tabulated data on 103 systems. Besides, there is an excellent summary for the country as a whole.

An Introduction to Crystal Analysis

By Sir William Bragg. New York: D. Van Nostrand Company, Inc. 168 pages, illustrated. Price, $4.50.

The study of matter by means of X-rays leads to crystallography, and in this book the author develops the fundamental principles of crystals, crystal behavior under X-rays and methods of analysis by use of rays and crystals. The arrangement of atoms is indicated, their sizes are discussed and the technique of crystal study for metals and alloys by X-ray methods is outlined. It is a condensed and clear exposition of a very important aspect of scientific work.

Berliner Städtische Elektrizitätswerke A.-G.

Jahrbuch der Verkehrsdirektion, 1928, Berlin. 118 pages, illustrated.

A review of the year's operations is attractively presented in a form that might well be emulated by other operating companies. The statistics are accompanied by descriptive matter on customer relations, new business, rates, business problems in the change from d.c. to a.c., co-operation with contractors, etc. The vigorous publicity methods abundantly illustrated in the booklet evidently bore fruit; the output increased 19 per cent during 1928. Financial data are not here included; they constitute a separate report.

Elektrische Bahnen

Fachheft der Zeitschrift des Vereines Deutscher Ingenieure (V.D.I.), Berlin. 48 pages, numerous illustrations.

The decade following the World War brought remarkable progress in railway electrification. The circumstance has been made the occasion for a special issue (No. 20, Vol. 73) of the *V. D. I. Zeitschrift,* devoted to detailed and liberally illustrated descriptions of current electric railroad practice in Germany and elsewhere. The mechanical features of various modern types of locomotives receive particular attention. Among the forms of overhead construction shown are some that differ materially from American practice. An introductory article briefly outlines the history of electric railway development since Von Siemens' first locomotive in 1879. A table of the mileage in various countries shows Switzerland in the lead.

Books Received

"Electrification of Steam Railroads." By Kent T. Healy. New York: McGraw-Hill Book Company. 395 pages, illustrated. Price, $5.

Siemens Jahrbuch, 1929. Siemens & Halske A.-G. und Siemens-Schuckertwerke A.-G. Berlin: V.D.I. Verlag G.M.B.H. 644 pages, illustrated.

News of the Industry

J. T. Newcomb Testifies

N.E.L.A. Report on Educators Corrected—Federal Trade Commission Also Hears from I. C. Copley, T. W. Martin and Others

YEAR-OLD letters from the files of the Joint Committee of National Utility Associations were brought to light in the Federal Trade Commission utility hearing of June 14, and Josiah T. Newcomb, chief counsel, was called upon to explain their purport. It was shown that the joint committee had been in touch with M. J. Insull, P. H. Gadsden and other utility executives concerning Boulder Dam, Muscle Shoals and various matters connected with power development by government. The correspondence included letters to editors and congressmen giving the utilities' views on these issues and urging support.

Another development at this hearing was the submission of a corrected report by the National Electric Light Association in connection with its payment to college and university professors for technical research work and reimbursement to them of expenses incurred in attending utility conventions and committee meetings. This placed the number of educators to whom a total of $46,000 was paid in eight years at 43 instead of 23.

On the previous day Colonel Ira C. Copley, proprietor of 23 newspapers in Illinois and California, appeared before the commission at his own request and said that he had never been connected with any public utility organization except the Western United Corporation and its subsidiaries in Illinois. He sold control to Messrs. Fitkin and Rollins in 1925. Two years ago the properties were purchased by the Insull interests. He still holds a block of shares in trust for others. He expressed indignation at Senator Norris' reflections upon him and challenged him to repeat them outside the privileged chamber of the Upper House.

Another witness on that day was W. J. Sylvester of the Industrial Conservation Board of Chicago. The board, said Mr. Sylvester, was formed following a conference of business men held in Washington in 1925 with the object of uncovering and making public details relating to governmental participation in business or industry. Out of more than a hundred industrialists on the board only four are public utility men.

The loan of $100,000 which was advanced to R. B. Chandler for the purpose of financing the newly established Mobile *Press* was traced to its source by detailed questioning of seven witnesses through the hearing of June 19. The witnesses included T. W. Martin, president, and W. Logan Martin, general attorney, of the Alabama Power Company; Abner Aldridge, president of the Southeastern Fuel Company and the Union Coal Company, Alabama Power Company subsidiaries, and Mr. Chandler himself. The hearing brought out that Mr. Aldridge borrowed $50,000 from Logan Martin, which he passed on to J. F. McGowin and which was later repaid. The other half was borrowed from E. F. Ladd's bank. T. W. Martin testified that no money from the power company or any of its associates went into the Mobile *Press*, and that he was unaware that the loan had been made till some weeks after it had been placed. The other witnesses told essentially the same story.

Adjournment was taken till Thursday, June 27.

Severance Claims Slashed

California Railroad Commission Allows P. G. & E. and Great Western Only Fraction of What Companies Ask from City of San Francisco

DECISION was given out by the California Railroad Commission on Monday, June 17, fixing the price to be paid by San Francisco for the electric systems of the Great Western Power Company and the Pacific Gas & Electric Company within the city, as they existed on February 11, 1924, at $11,815,000 and $26,685,000 respectively. The Great Western company had valued its property plus severance damages at approximately $30,000,000, and the Pacific Gas & Electric Company had valued its holdings and damage at $60,000,000, while the city had set figures at $9,000,000 and $19,000,000.

The Pacific Gas & Electric Company's properties on the date named included a 64,000-kw. steam generating plant, nine substations, more than 20,000 poles and more than 3,500 miles of wire and cable. The cost of reproducing this property in 1924 was estimated by the commission's engineers at more than $25,000,000. After making deductions for depreciation and additions for the value of the business, the commission fixed, as a just compensation to be paid by the city, the sum of $23,635,000. The company's claim had exceeded $32,000,000. The commission allowed an additional $3,050,000 for severance damage, for which the company had claimed $27,000,000, while the city contended that $457,000 would be sufficient.

The Great Western company's property includes two steam plants with a total capacity of about 23,000 kw., four substations, 5,000 poles and more than 800 miles of wire and cable. Estimating the cost of reconstructing the property in 1924 at $7,552,000 and making deductions for depreciation and an additional allowance for the value of the business, the commission set the figure to be paid by the city at $8,440,000 and severance damage at $3,375,000. The company had set this damage at $15,000,000 and the city at $2,766,000.

Claims for just compensation had been bassed by both companies principally upon the loss of net revenue which each would suffer through having its San Francisco property and business cut off from its entire system, but the commission based its findings upon an inventory and appraisal of the physical properties with an additional allowance for the value of business.

A further investigation will be necessary to determine the increase in value of the properties by reason of additions and improvements since February 11, 1924, the Pacific Gas & Electric Company estimating its expenditure for betterments at $10,000,000 and the Great Western company its at $3,500,000.

Both companies have expressed their intention of asking the commission for a rehearing, and if that is denied, of appealing to the Supreme Court of the state for a writ of review.

Niagara Falls Leads Off

Following the Preliminary Celebration of "Light's Golden Jubilee" at Atlantic City, the City by the Cataract Has Sevenfold Festivities

NIAGARA FALLS, N. Y., held an elaborate and effective four-day carnival last week in which the celebration of "Light's Golden Jubilee" played a conspicuous part. The celebration, beginning on Thursday and ending Sunday, included the first local development of the national jubilee program, the fifth annual festival of lights, the two hundred and fiftieth anniversary of Father Hennepin's arrival at the Falls, the fiftieth anniversary of the use for lighting purposes of power generated by the waters of Nigara, the dedication of the municipal airport, a convention of a fraternal order and Flag Day exercises.

The culmination of the fête was on Saturday, when a costumed party arrived on a fifty-year-old railroad train and journeyed by horsecar, coach and hack to Prospect Park. Here was in operation a replica of the pioneer electrically illuminated fountain which drew tourists to Niagara fifty years ago and for which the first electrical energy generated at the Falls was used. The 1,440,000,000-cp. searchlight battery on the Canadian side was fully equipped with golden color screens in addition to those in regular use, and the splendid effects obtained surpassed anything previously done.

A.I. and S.E.E. Breaks Attendance Record

Quarter-Centennial Convention at Pittsburgh Marked by Valuable Papers and Worth-While Discussions—Exhibits Made by Manufacturers of Equipment Number 138

CELEBRATING its twenty-fifth annual convention with both record-breaking attendance and one of the largest industrial expositions ever held by the industry, the Association of Iron and Steel Electrical Engineers met in Pittsburgh this week. Officially, the convention was opened by a telephone-radio greeting from New York by James A. Farrell, president of the United States Steel Corporation, on Monday night. Mr. Farrell, in greeting the delegates assembled in the lobby of the William Penn Hotel, credited the electrical engineers of his industry and the widespread adoption of electrical energy to its manufacturing problems as dominant factors in its progress.

The program included meetings of the electrical, safety and combustion engineering divisions. Of particular interest to electrical engineers at the Monday sessions were the papers of S. S. Wales and V. R. Bacon. In making his report as chairman of the electric welding committee of the association, Mr. Wales pointed out the predominant advantages of electric metallic arc welding where a variety of operations must be performed with the same tool and where speed is important. For repetitive manufacturing processes other welding methods were conceded to be more satisfactory. Mr. Wales stated that he anticipated great advances in the art, both as to the quantity of material welded and the diversity of applications. In discussing Mr. Wales' report, A. H. Candee remarked that as welding was now being used for new developments in fabricating processes rather than for repairs only, its expansion may be greater each year. Welded construction, said Mr. Candee, may be used with confidence wherever steel is employed.

"Too much emphasis cannot be placed on the necessity of thorough correlation, for the promotion of general safety, between the building details and the allocation of electrical equipment," V. R. Bacon declared, in discussing safety in electric station design. "If a plant is to be ultimately safe it must be designed for safety." It was Mr. Bacon's contention that every piece of equipment and its functional duty must be fully considered, and he advocated co-ordinated design by structural, mechanical and electrical engineers to avoid dangerous practices. This view was approved by C. L. Baker, Walter Greenwood and F. W. Cramer, who referred to specific instances where better co-operation is needed.

The report of the electric heating committee, prepared by Chairman G. H. Schaeffer, was presented by George Mills on Tuesday. This report offered a recapitulation of low-, medium- and high-temperature treating and of melting applications. New developments include forced and natural convection, low-temperature installations, electromagnetic control through demagnetizing of steel with temperature rise, curve-drawing instruments which also indicate the demagnetization point, the introduction of accelerative cooling for temperatures below 1,200 deg. F., and improved economies and performance of galvanizing, annealing, carburizing and car-type equipment. The use and advantages of combined electric and oil-fired furnaces were enumerated. The largest melting furnace now in use is said to be a 100-ton Herault.

The growth of the electric drive in various steel-mill applications and the pronounced trend toward direct-current motors for such work were covered in the report of the electrical development committee, which Chairman W. H. Burr presented. The decline of the alternating-current speed set to only one installation in 1928 was deemed significant. Mr. Burr referred to developments in the art of special interest to iron and steel men.

In the discussion of this paper G. E. Stoltz stated that the gain in the use of strip mills and the decline in output of plate or sheet mills were directly attributable to the trend toward direct-current motors. J. Whinny mentioned that the limiting size of a direct-current motor is now controlled by the size of the material for magnetic slabs which the steel mills furnish, being 5,000 hp. Mr. Whinny also mentioned that the correction of plant power factor by means of synchronous motors had gone so far in one plant that induction motors were now being added to stabilize voltage conditions. J. Farrington advocated clean air for space in which auxiliary control apparatus is located, citing the 50 per cent reduction in trouble at one plant when using washed air.

Organization for good electrical division efficiency was outlined by J. J. Booth, of the shop practices committee, on Wednesday. He advocated a further co-ordination of plant operation with the electrical engineering staff. At the same session L. A. Umansky presented a paper of "The Selection of Electric Equipment," it being the author's opinion that the correct selection of electrical machinery, on the bases of the data conventionally submitted with the most complete proposals, is an extremely difficult task likely to receive superficial handling. Mr. Umansky urged the rejection of old standards for equipment specifications and pointed out the folly of using weight of equipment as a standard for comparative purposes. Performance was suggested as the only worth-while criterion of merit, efficiencies being subordinate in importance. In the discussion F. W. Cramer referred to misunderstandings as to motor ratings and performances and pointed out that early name-plate ratings were highly conservative, while today's come closer to defined quantities. F. O. Schnure advocated motors of sufficient size to handle any operating emergency. This thought was developed further by A. J. Standing, who conceded the value of accurate horsepower ratings for given temperatures but urged the use of larger-capacity equipment for nominal mill needs.

On Thursday the general subject of portable electric tools was discussed by J. S. Murray, chairman of the committee on that subject, and W. M. Runyon considered the grounding practices there followed. G. E. Stoltz spoke of "Some Methods of Best Utilizing Electrification in the Steel Industry," and urged the further encouragement of the development of new methods and new processes through co-operation with equipment manufacturers.

The final session on Friday was devoted to "Lighting Survey of Steel Plants," by S. G. Hibben, and "Time Current Control for Direct-Current Motors," by D. C. Wright.

Informal and formal receptions on Monday and Thursday evenings respectively, inspection trips and other "get-together" meetings were held. Approximately 1,500 registrations were made in the first three days. C. S. Proudfoot is president of the association and F. W. Cramer is chairman of the electrical engineering division. John F. Kelly is managing director. Exhibits were offered by 138 manufacturers of electrical equipment.

North Central Association's Two-Day Meeting

First of the geographic divisions of the N.E.L.A. to employ the new convention device of talking motion pictures, the North Central Electric Association heard "movietone" addresses by Thomas A. Edison, Sir Ernest Benn of London and M. S. Sloan, president-elect of the national body, when it met on Monday and Tuesday of this week at Breezy Point, near Pequot, Minn., for its annual assembly. More than 350 members and guests were in attendance.

Paul S. Clapp, managing director of the N.E.L.A., spoke on electric development problems; Fred Herbert, service director N.E.L.A., discussed "Service"; Major H. S. Bennion talked on radio interference; O. S. Powell, Federal Reserve Bank, Minneapolis, and W. N. Rademacker, Edison Lamp Works, Chicago, were other speakers. T. D. Croker, Minneapolis, addressed the banqueters Monday evening on "Trading Places with Ontario." President L. M. Pharis, Duluth; J. A. Colvin, Minneapolis; W. S. Hodgson, Duluth; C. J. Strike, Huron, S. D., and Miss Mabel Wilson, Minneapolis, led sectional discussions.

New officers elected are: President, T. T. Parker, Huron, S. D.; vice-president, B. W. Cowperthwait, Faribault, Minn.; treasurer, J. A. Hennessy, Minneapolis; secretary-manager, John W. Lapham (re-elected).

C. F. Brush, Arc-Lighting Pioneer, Dies

Pneumonia Removes Octogenarian Inventor and Man of Affairs at His Cleveland Home—His Lasting Contributions to the Electrical Art

THE death in Cleveland on Saturday night, June 15, from pneumonia, of Charles Francis Brush, at the age of 80, removes from the dwindling ranks of electrical pioneers one who took front rank in the early development of the arc lamp, who made valuable contributions to generator design and who did much to develop and perfect the lead storage battery, the fundamental invention of which he claimed as his own. During the many years when the arc light dominated the entire field of street illumination by electricity his name came to be closely identified in the public mind with the evolution of city thoroughfares from the semi-darkness that had formerly prevailed after sunset and with the brilliant illumination that the arc-light systems first made possible for stores and public buildings of certain types. His contributions to the electrical art will be lasting, even if arc lighting becomes a thing of the past.

C. F. Brush

Born in Euclid, Ohio, on March 17, 1849, young Brush, after a high school course, entered college and was graduated from the University of Michigan as a mining engineer at twenty years of age. He began life as an analytical chemist, but he had already become interested in electrical experimentation and soon turned his attention exclusively to matters in that field. As early as 1876 a dynamo was constructed from his design which was exhibited at the Paris Exposition as well as in the United States. In 1878 he gave to the world the Brush system of arc lighting, the first complete system of his design being installed in Cleveland, his home. In 1881 the Brush Electric Company was incorporated with a capitalization of $3,000,000. This company was absorbed by the General Electric Company about ten years later and its works removed from Cleveland to Schenectady. In the meantime other corporations had been formed in various parts of the world and the Brush apparatus and system had been widely introduced.

To Mr. Brush are attributed the first use of iron laminations in generators, the copper plating of carbon brushes, and the damper winding in which a copper band is used between the field magnets and the coils surrounding them, as well as the compound winding since widely used on direct-current machines. His patents were sustained by repeated decisions in United States courts, those on the "double-arc lamp" being upheld in sixteen different decisions.

Mr. Brush had financial as well as inventive ability in very high degree and early became a prominent figure in business. He was at one time president of the Euclid Avenue National Bank in Cleveland and was at the time of his death, or had been, an officer or director of numerous business organizations, such as the Cleveland Arcade Company, the Linde Air Products Company, which he founded, and the Cleveland Chamber of Commerce. Of the three named he had been president, holding that office with the Cleveland Arcade Company from 1887 until his death.

Many honors came to the inventor. In 1881 his achievements in the field of electric lighting were recognized by the French government, which made him a chevalier of the Legion of Honor; in 1899 he received from the American Academy of Arts and Sciences the Rumford medal "for the practical development of electric arc lighting"; in 1913 the American Institute of Electrical Engineers recognized his accomplishments by awarding him the Edison medal, and a year ago the Franklin Institute of Philadelphia gave him its Franklin medal. He received the degree of doctor of science from the University of Michigan in 1912. Previously the Western Reserve University in Ohio had made him the recipient of a Ph.D. and an LL.D. He was a trustee of several educational institutions.

Mr. Brush was a fellow of the American Academy of Arts and Sciences, the American Physicists' Society, the American Geographical Society and the British Academy of Arts and was a life member of the British Association, the Ohio Chamber of Commerce and the American Society of Mechanical Engineers. He was also a member of the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Philosophical Society, the Illuminating Engineering Society, the Franklin Institute and various other technical or cultural associations.

Until his recent illness Dr. Brush had insisted upon remaining active. As his life ended the American Philosophical Society was announcing him as national chairman of the society's campaign for an endowment and building fund. He was to have had a place of honor in the Cleveland celebration of "Light's Golden Jubilee." He was a man of philanthropic tendencies, and one of the last acts of his life was the establishment of the Charles E. Brush Foundation for the Betterment of the Human Race. To this he donated $500,000 and placed it in trust in memory of his son, Charles F. Brush, Jr.

Tripartite New York State Merger a Fact

Niagara-Hudson Power Corporation Comes Into Being as Morgan-Controlled Body, with F. L. Carlisle as Chairman of Board and R. P. Stevens as President

SUBSTANTIAL accuracy of the reports carried for some time in New York City and other newspapers concerning a merger on a huge scale of upstate New York companies was established on Tuesday of this week when J. P. Morgan & Company announced a consolidation under their auspices, as sponsors of the United Corporation, of the Buffalo, Niagara & Eastern Power Corporation, the Northeastern Power Corporation and the Mohawk-Hudson Power Corporation.

The announcement bears out the press story reprinted in the ELECTRICAL WORLD last week (page 1251), with the exception that the Central Gas & Electric Corporation, the Rockland Light & Power Company and the Eastern States Power Corporation (a holding concern) are not included.

On Thursday afternoon the terms of exchange were announced as follows: Two and two-thirds shares and two-thirds of an option warrant of the new holding-company common stock for each share of Northeastern common; three and one-half shares and seven-eighths of an option warrant for each share of Mohawk-Hudson common, and four shares and one option warrant for each share of Buffalo, Niagara & Eastern. An option warrant confers the right to purchase one share of common stock at $35.

Officers of the Niagara-Hudson Power Corporation are: Chairman of the board, Floyd L. Carlisle; president, Ray P. Stevens; vice-presidents, Alfred H. Schoellkopf and E. L. West; chairman of the executive committee, George H. Howard.

Purchases and Mergers

Formal Application for Transfer of Osage River Project Is Filed—Small Transactions in New England, Pennsylvania, Middle West and South

FORMAL application has been filed by the Union Electric Light & Power Company of St. Louis for permission to buy the franchises and property of the Missouri Hydro-Electric Company in connection with the hydro-electric development on the Osage River five miles above Bagnell, Mo. The latter company filed an accompanying application for permission to sell. A hearing will be held by the Missouri Public Service Commission on June 25. This transfer is the last step before the start of actual construction on the thirty-million-dollar project.

The Lisbon (N. H.) Light & Power Company has been acquired by the Public Service Company of New Hampshire, considerably strengthening the Insull holdings in the northern section of the Granite State. The Bethlehem (N. H.) Electric Light Company has also been added to the Public Service group.

The Huntington (Mass.) Electric Light Company has been sold to Glidden, Morris & Company, investment bankers of New York. This concern controls the Colonial Utilities Corporation, which operates public utility companies in New Hampshire, Vermont, Connecticut and New Jersey. The lines of the Huntington company are about to be extended to Norwich Lake.

As the result of adverse court decisions, the Public Service Electric & Gas Company of New Jersey announces that it has abandoned its plan to merge the Essex & Hudson Gas Company, the Hudson County Gas Company, Paterson & Passaic Gas & Electric Company, Somerset, Union & Middlesex Lighting Company and New Brunswick Light, Heat & Power Company. All these companies are already controlled by Public Service.

The Penn Central Light & Power Company has added to its system the Barnesboro & Spangler (Pa.) Electric Light Company in the heart of the Cambria County bituminous coal field.

Approval of the merger of three electric companies serving contiguous territory in western Pennsylvania into a new Pennsylvania Power Company is asked of the Public Service Commission. The companies are the Pennsylvania Power Company, the Harmony Electric Company and the People's Power Company. All are owned by the same interests and the consolidation will be financed by an exchange of stock.

By a majority of 312, Randolph, Wis., has voted in favor of selling for $39,500 the municipal power and light plant to the Wisconsin Power & Light Company. The vote, held June 11, was 433 to 131. This year's vote reversed one in 1927. Sale of the municipally owned electric distribution system of Loyal, Wis., to the Northern States Power Company, at a minimum price of $13,000, has been approved by the Railroad Commission.

Petition for authority to purchase the Evansville (Ill.) Electric Company and its electric distribution system in Baldwin, Walsh, Preston and Ellis Grove has been filed by the Illinois Power & Light Corporation.

On July 2 Pierre, S. D., will vote upon whether to sell its municipal electric light and power plant. Two companies are reported to have submitted definite proposals for the purchase of the plant, with two more bids expected.

Residents of Texola, Okla., have voted to sell the municipal electric generating plant and lines to the Southwestern Light & Power Company.

The Tennessee commission has issued an order approving the purchase of the Gordonsville light plant by the Tennessee Electric Power Company for $6,000.

The Yuba River Power Company has applied to the California Railroad Commission for authority to sell to the Pacific Gas & Electric Company its hydro-electric properties on the North Fork of the Yuba River, consisting of a dam and a hydro-electric generating plant with an installed capacity of 8,125 kva., together with transmission lines. The properties have been under lease by the Pacific Gas & Electric since 1922.

In the Legislative Mills

Massachusetts Facilitates Establishment of Municipal Plants and Orders Investigation of Utility Control—Wisconsin Assembly Is for State Ownership.

MASSACHUSETTS.—Two important bills were passed by the Legislature in regard to public utility affairs during the closing days of the recent session. Chapter 379 makes it easier for a city or town to enter the municipal lighting field by authorizing the Department of Public Utilities to fix the price at which a private company's plant may be taken over in case of disagreement as to price after the city or town votes to acquire such portion of the company's plant and system within the municipality as the city or town requires for its use. The commission also is required to fix severance damages if any. If the company refuses to accept the commission's price, the municipality may then proceed to build or acquire a lighting plant of its own. In fixing the value of the company's plant the commission is required to estimate this without enhancement on account of the future earning capacity or good will. The commission may authorize a municipality to serve adjoining cities or towns.

Resolve No. 55 orders a special commission to investigate controlling financial interests in gas, electric or power utilities exercised within the state by other corporations, trusts, associations, partnerships or individuals. The commission is to consist of one state senator, three state representatives and three persons to be appointed by the Governor, all to serve without pay and report finding by December 4 next.

WISCONSIN. — State ownership and operation of water-power and other electric utilities was indorsed by the Wisconsin Assembly on June 12, when by a vote of 71 to 19 the constitutional amendment proposed by Assemblyman Alvin C. Reis was passed. This amendment, which will require approval of the 1931 Legislature and a referendum of Wisconsin voters before becoming effective, is one of those backed by the League of Wisconsin Municipalities and is the outcome of extended hearings conducted by the judiciary committee over a period of four weeks. The judiciary committee recommended that a bill enabling cities to construct and operate utilities without obtaining a certificate of convenience and necessity from the Railroad Commission be defeated.

Two other utility proposals received final action in the House and were sent to the Senate. One is a proposed constitutional change to remove from existing debt limitation any indebtedness created for the purpose of acquiring or constructing a municipal utility. The other allows the Railroad Commission to consider two or more municipalities as a regional unit for rate-making purposes when they are served by the same utility.

The Upper House killed the Hunt bill, which provided that municipalities and farm co-operatives could build utility plants without regard to existing privately owned systems and then enter into competition with them.

Colorado River Conference Adjourns Till October

Adjournment of the tri-state conference on the division of the Lower Basin waters of the Colorado River was taken on Friday, June 14, without an agreement having been reached between Arizona, Nevada and California. Although it is still believed that Arizona will seek to determine her rights through Supreme Court action, the delegates were thought to be in closer accord at the end of the session than ever before. The next meeting will be held on October 14 at Santa Fe.

At the close of the conference Colonel W. J. Donovan, chairman, submitted a simplified proposal for the state commissioners to consider during the interim. His statement reads:

The following formula is submitted not as a recommendation but simply as a suggestion which the states might accept as a basis in attempting to reach a conclusion. This formula is based on the principle that, as nearly as may be, the water of the Lower Basin shall be equally divided between Arizona and California. This principle must be kept in mind in considering the feasibility of this plan.

1. The Gila River shall go to Arizona.

2. Arizona may use any of the unused waters of her tributaries other than the Gila, releasing therefor equivalent water from her main stream waters.

3. Of the 7,500,000 acre-feet of water on the main stream apportioned to the Lower Basin by Paragraph a of Article III of the Colorado River compact, 300,000 shall be apportioned to Nevada.

4. Of the 7,200,000 acre-feet remaining and of the 1,000,000 acre-feet provided for in Paragraph b of Article III of the Colorado River compact, Arizona and California shall each receive such a percentage as may seem fair and equitable.

5. The additional available waters in the Lower Basin shall be divided equally between Arizona and California.

6. The Mexican burden shall be borne equally by Arizona and California.

Illumination Conference Next Week at W.L.I.

The first annual illumination conference of the Westinghouse Lighting Institute will be held in the Grand Central Palace, New York, where the institute is now in full operation, on June 24, 25 and 26. This conference is intended primarily for experienced illuminating engineers actively engaged in lighting practice and those interested in spectacular and decorative lighting. On September 19 to 21 there will be a course for beginners, covering fundamentals and general principles, and on October 7 to 9 a course for women in home lighting. Next week's program follows:

MONDAY, JUNE 24

Morning.—Welcome and plan of conference, Vice-president A. E. Allen, Institute inspection: Ralph Neumuller, director; auditorium, S. G. Hibben; Mazda Avenue, art gallery and schoolroom, W. A. Oglesby; electric shop and central-station display room, E. M. Beach; public hall, reception room and director's office, D. W. Atwater; home, Miss Evelyn Duval

Afternoon.—Continuation of institute inspection: Street lighting, A. J. Sweet; automotive lighting, R. E. Carlson; transportation room, R. W. Cost. Spectacular and display lighting: D. W. Atwater, chairman; electrical advertising and signs, E. A. Mills, New York Edison Company; color and motion in floodlighting, C. J. Stahl.

TUESDAY, JUNE 25

Morning.—"Light's Golden Jubilee," C. A. Norton (plan book, proposed program and activities); characteristics of signs and decorative "Mazda" lamps, H. S. Broadbent; accessory equipment, R. M. Eames, Bryant Electric Company; decorative lighting possibilities with small lamps, E. W. Beggs; the Holland Tunnel, Ole Singstad, chief engineer.

Afternoon.—Trip through Holland Tunnel via bus to Bloomfield (N. J.) works; inspection of lamp manufacturing.

WEDNESDAY, JUNE 26

Morning.—Electrical requirements of decorative outdoor lighting, A. R. Small, Underwriters' Laboratory; how the central station can help the architect, LeRoy Kern, American Institute of Architects; decorative lighting of natural wonders, W. A. Oglesby; "Light's Golden Jubilee" installations, A. Paulus.

Afternoon.—Discussion of decorative lighting, S. G. Hibben, chairman.

Dean Madden Defends the N.E.L.A. Research Work

No cause exists for public alarm over the testimony before the Federal Trade Commission that certain college professors have been receiving remuneration for research work done for the National Electric Light Association, Dean John T. Madden of the School of Commerce, Accounts and Finance of New York University told members of the Metropolitan New York Section of the National Electric Light Association last week when they assembled for a one-day convention.

Dean Madden said that when the association asked him to undertake a piece of research a clause was inserted in the contract specifying that the N.E.L.A. would publish the results of his research no matter what it should reveal or else permit him to do so in whatever form he deemed best. He said that in his university no restrictions are placed on the personal opinions of professors and instructors and, while he reserved to himself the right to assist the electric light and power industry, any professor who chose could speak in the cause of the municipal ownership of utilities or even socialism.

Municipal League of Seattle Indorses Light Department

Following the public dispute in which the management of the Seattle light department was attacked by certain city officials (ELECTRICAL WORLD, April 6, page 702), the Municipal League, which headed an investigation of the department, has adopted the report of its city light committee (ELECTRICAL WORLD, June 1, page 1115), which supports the department and its head, J. D. Ross. The report covered several months of careful scrutiny, particularly with regard to the Skagit River power development.

A board of experts, working under the direction of Mayor Frank Edwards and the City Council, is now, in accordance with the recommendation of the committee, making a thorough investigation of the entire light department. Prior to the favorable action taken by the Municipal League an effort was made to prevent a vote of the membership until after the submission of the experts' report.

Sectional Meetings of Empire State Association

Simultaneously, at Watertown and Niagara Falls, N. Y., respectively, the Accident Prevention Section and the Commercial Section of the Empire State Gas and Electric Association held meetings on Thursday and Friday of this week. Electricity as an aid to airport safety was the topic of L. S. Bowker of Malone, N. Y., at the Accident Section meeting; accident prevention in relation to insurance was to be discussed by T. H. Prendergast of the Long Island Lighting Company, methods of reducing industrial accidents by J. J. Whitmer of Brooklyn, safety rallies and speakers by J. A. McCarthy of New York, and testing safety apparatus by M. F. Skinker of Brooklyn. A trip through the Thousand Islands was scheduled.

On the Commercial Section program were: "Merchandising Policies," M. E. Skinner, vice-president New York Power & Light Corporation; "Power Sales Promotion," W. R. Dixon, New York Power & Light Corporation; "Some New Commercial Opportunities," Charles S. Ruffner, president Empire State Gas and Electric Association; "Rural Electrification," John Costello, Niagara, Lockport & Ontario Power Company, and "Domestic Electric Sales Promotion," F. M. Houston, Associated Gas & Electric System, and J. H. Van Aernam, New York Power & Light Corporation.

The delegates crossed over to the Canadian side for golf and dinner.

Program for Michigan State Association's Meeting

At the joint session of the Michigan Electric Light Association and the Michigan Gas Association at Mackinac Island on Monday, July 1, A. C. Marshall, chairman of the state Committee on Public Utility Information, will report and Mrs. S. W. Judd, president Michigan League of Women Voters, will make an address, as will Vice-President W. J. Hagenah of the Byllesby company and President O. H. Fogg of the American Gas Association.

Tuesday and Wednesday the Electric Light Association will hold separate sessions. On Tuesday, following the address of President Howard Pett, Prof. H. J. Gallagher will report for the rural electrification committee and three addresses on "Rural Electrification Research," "A Farmer's Experience in the Use of Electricity" and "Technical Problems Involved in Building Rural Lines" will be made respectively by L. C. Moore of Michigan State College, Walter Carven and F. W. Bagnall of the Detroit Edison Company, the last named in co-operation with F. W. Pollock of Stevens & Wood.

On Wednesday "Off-Peak Water Heating by Electricity" will be discussed by R. R. Clark, Consumers Power Company; "Outdoor Meter Installations" by J. C. Langdell, Consumers Power Company and others; "Comparative Costs of Generating Electricity by Water Power and by Steam" by E. M. Burd of Stevens & Wood, and "Building of Electric Power Lines and Trimming Trees Along State Highways" by Phelps Vogelsang, State Highway Department.

Farm Conference at Virginia Polytechnic Institute

Electrification of the farm was the general theme of the first annual rural electrification short course given at Blacksburg, Va., on June 12 to 14, under the direction of the agricultural engineering department of the Virginia Polytechnic Institute. The second and third days' programs stressed specific uses of electricity on the farm. Methods of merchandising farm equipment were also discussed. More than seventy-five representatives from power companies and organizations interested in electricity as it affects agriculture took part in the discussions.

Dr. Julian A. Burruss, president of the Virginia Polytechnic Institute, in welcoming the attendants, showed where the development of rural power lines would assist in the diversification of industry. A general survey of rural electrification conditions in Virginia was presented by Charles E. Seitz, head of the agricultural engineering department at the institute; J. W. Hancock, division manager of the Roanoke and Lynchburg division of the Appalachian Electric Power Company, discussed a program for rural extensions; George W. Kable, director of the "national rural

electric project," discussed electric power as a logical development in American agriculture, and irrigation, the dairy industry, the poultry industry, water systems and many other aspects of farm work were canvassed from the electrical standpoint. Miss Eloise Davison talked on electrical equipment for the home.

Briefer News

RATES CUT IN SOUTHWEST MISSOURI.—The Missouri Public Service Commission on June 10 authorized the Missouri Public Service Company to establish new and somewhat lower schedules of rates in about sixty towns and villages in the southwest part of the state. The new rates become effective on July 1.

LOS ANGELES ELECTRIC CLUB'S NEW OFFICERS.—Results of the annual election of the Los Angeles Electric Club have been announced as follows: President, Frank J. Airey, district manager Pacific States Electric Company; first vice-president, Roy Foulkes; second vice-president, H. W. Dennis; third vice-president J. H. Pengilly; secretary-treasurer, C. Thorburn.

NORWALK, OHIO, ELECTS TO GO IT ALONE.—Announcement that the Ohio Supreme Court has upheld the ouster proceeding brought against the Ohio Electric Power Company by the city of Norwalk is greeted there as a victory for municipally owned utilities. The power company has been operating in competition with the city's power plant. City officials charged that its operation was illegal in that it had no franchise. The company offered to purchase the city's plant two years ago. After a heated controversy the offer was rejected.

RURAL EXTENSIONS IN MANITOBA.—Progress is soon to be made in the extension of rural electric lines in Manitoba. This year's program, which was outlined before the Legislature, calls for the expenditure of $700,000 in the southern and western parts of the province. Included is the extension of lines from Virden, near the western boundary. The speed with which the extensions are built depends on how soon the municipalities pass bylaws signifying participation. Premier Bracken forecasts that the provincially owned system will operate about 10,000 miles of transmission lines in sixteen years.

A.S.T.M. MEETS NEXT WEEK AT ATLANTIC CITY.—On Monday, June 24, the American Society for Testing Materials will begin its annual meeting at Atlantic City to continue until June 28 inclusive. Dr. Saul Dushman, assistant director of the General Electric research laboratory at Schenectady, will give the fourth Edgar Marburg lecture on Wednesday afternoon, taking as his subject "The Nature of Cohesive Forces in Solids." The usual copious program of reports includes those of the committees on electrical insulating materials (H. S. Vassar chairman), copper wire (J. A. Capp), high-temperature and electrical resistance alloys (Dean Harvey), and a discussion of life tests on metallic resistor materials for electrical heating by F. E. Bash and J. W. Harsch.

FLOODLIGHTING A SEATTLE TOWER.—Changing colors lend additional beauty at night to the 27-story Northern Life Insurance Tower at Seattle, which rises 327 ft. above the sidewalk. The floodlighting is supplied by "Permaflector" floodlamps, the product of the Pitts-

burgh Reflector Company. Thirty-two of these use 250-watt bulbs, 120 use 1,000-watt bulbs and 48 use 300-watt bulbs, giving a total illumination of 142,400 watts.

CENTRAL POWER & LIGHT COMPANY TO BUILD STEAM STATION ON DEVIL'S RIVER.—The Central Power & Light Company, whose developments on Devil's River Tex., were noted last week (page 1254), has let the contracts for its third generating plant on that stream. It has been decided to make this a steam plant. It will be built about three miles from the mouth of the Rio Grande and will have a rating of 15,000 kw.

PRIZES AWARDED IN JUBILEE ESSAY CONTEST.—Notwithstanding that only a month was available for preparation, 162 essays were submitted by member-company employees in the essay contest of the N.E.L.A. "Light's Golden Jubilee" committee (ELECTRICAL WORLD for April 13, page 751. The first prize ($150) was awarded to William N. Fisher, Los Angeles Gas & Electric Corporation; second prize ($75) to William T. Galloway, Middle West Utilities Company, and honorable mention to Travis L. Bogue, Public Service Company of Oklahoma.

SALEM, ORE., ACCUSES NORTHWEST POWER COMPANY OF BAD FAITH.—A brief filed with the State Engineer of Oregon by the city of Salem accuses the Northwest Power Company, which is applying for permission to appropriate water from the Santiam River and Marion Lake, of not acting in good faith but filing for speculative purposes only. This the company denies. A joint hearing before the State Engineer and a representative of the Federal Power Commission will soon be held.

BEEBE ISLAND (N. Y.) HYDRO-ELECTRIC DEVELOPMENT POSTPONED.—Members of the Beebe Island Corporation, a combination of manufacturers on Black River at Beebe Island, N. Y., who own the power rights, have decided not to develop them this summer. The Beebe Island Corporation was formed about fifteen years ago, and at that time an agreement was entered into by utilities, five industrial firms and the city of Watertown to develop the power jointly. A move was started to build a plant, but this was held up. Under ordinary circumstances about 9,000 hp. could be developed.

MOUNT FRANKLIN BEACON AT EL PASO DEDICATED.—The "Pasotex" aviation beacon on Mount Franklin at El Paso, dedicated two or three weeks ago, is served by the El Paso Electric Company over a 23-kv. line which ascends the steepest side of the mountain. Transformers were hauled up the mountainside by hand, poles dragged to their locations and set-in holes blasted out of solid rock. The 10,000,000-cp. revolving light, which is visible for 100 to 150 miles, is similar to the beacon on Mount Diablo near San Francisco Bay. It is equipped with two lamps, one of which is automatically switched on in case the other fails. In addition a 3,000,000-cp. stationary beacon has been installed.

SEATTLE'S PROJECTS AT DIABLO DAM AND HANGING ROCK.—In pursuance of the program for development of the city's Skagit River power project, contract has been let to drive a tunnel from the Diablo Dam across a bend of the river to the site of the proposed power house at Reflector Bar. The contract was awarded on a bid of $544,894. The utilities committee of the Seattle City Council has voted to abandon the plan for a three-million-dollar dam at Hanging Rock on the Skagit River and instead to raise the crib dam now serving the Gorge Creek power plant 2 ft. at an estimated cost of $25,000.

SERVING THE FARMERS IN SOUTH DAKOTA.—Farm service in South Dakota and how to advance it were discussed at a meeting of the South

Dakota committee on the Relation of Electricity to Agriculture at Sioux Falls on May 28. Meeting with the committee was another from the State College at Brookings, a number of farmers of South Dakota and western Minnesota, Charles F. Stuart, chairman of the rural electric service committee of the N.E.L.A., and Dr. E. A. White, Chicago, director of the national committee. Of particular interest was a discussion of the Renner farm-line experiment, over which farmers are served by the Northern States Power Company.

NEBRASKA VEERS TOWARD PRIVATE OWNERSHIP.—A drift away from municipal ownership in Nebraska has been apparent recently. After a warm campaign Nebraska City, where the Central Power Company has a million dollars invested in utility plants, granted a twenty-year renewal franchise by a vote of two to one. The city of Friend voted down a municipal plant proposal and renewed for ten years the present franchise of the Iowa-Nebraska Light & Power Company. By a vote of 124 to 74 the village of Craig voted to sell its municipal plant. It will get transmission-line service on a lower rate schedule.

CENTRAL ARIZONA COMPANY EXPANSION.—The Central Arizona Light & Power Company of Phoenix will spend $4,350,000 in development during the next fiscal year, company officers announce. The program includes the steam-electric plant noted June 8 (page 1214), to cost $2,500,000; new transformers and frequency changers and transmission and distribution lines and extensions, besides gas equipment. With the completion of the power line between Phoenix and Tempe, Ariz., the latter city will be placed on the same competitive basis as other towns in the Salt River Valley.

NEW OFFICERS FOR NEW YORK ELECTRICAL SOCIETY.—Dr. H. C. Rentschler, director of research of the Westinghouse Lamp Company, was elected president of the New York Electrical Society at its annual meeting last week, Dr. Byron E. Eldred, O. H. Caldwell and F. L. Devereux vice-presidents, F. M. Delano secretary and E. B. Meginnis treasurer. At the meeting, which was held in the auditorium of the new Westinghouse Lighting Institute, Dr. Rentschler demonstrated a device for measuring the intensity of the ultra-violet ray which is expected to be of great importance in the treatment of disease.

MORE HYDRO POWER FOR HOLYOKE.—The Holyoke (Mass.) Water Power Company is considering the building of two new power stations this season, it is learned from President Robert E. Barrett. The largest project the company has in view is at the south end of its stone dam. No definite figures are available as to the extent of this development. In addition to this it is proposed to build stations at several overflows in the system. The first of these will be near the mill of the Franklin Paper Company and the next probably near the Germania Mills. About 2,000 hp. is likely to be developed at each of these overflows, it is said.

NEW HAMPSHIRE COMPANY'S BIG TRANSMISSION LOSS IN SERVING MAINE.—At recent hearings on Kittery and Eliot (Me.) petitions in opposition to electric rates charged by the New Hampshire Gas & Electric Company, which has served those towns since 1917, statistics were produced to show that while 778,040 kw.-hr. was metered at the Interstate Memorial Bridge only 545,543 kw.-hr. was sold to consumers in the two towns, 29 per cent of the energy being lost in transmission owing to the sparsely settled territory served, as against 6½ per cent in other towns supplied by the company. The New Hampshire company maintained that new area rates, which are opposed, would mean a saving to consumers. The hearings were adjourned until July 9.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

American Society of Agricultural Engineers—Baker Hotel, Dallas, Tex., June 24-27, Raymond Olney, St. Joseph, Mich.

American Institute of Electrical Engineers—Swampscott, Mass., June 24-28; Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Chalfonte-Haddon Hall, Atlantic City, June 24-28. C. L. Warwick, 1315 Spruce St., Philadelphia.

Northwest Electric Light and Power Association—Seattle, June 26-28. B. Snow, 1206 Spalding Bldg., Portland, Ore.

Michigan Section, N.E.L.A.—Mackinac Island, July 1-3. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

American Society of Mechanical Engineers—Salt Lake City, July 1-4. C. W. Rice, 29 West 39th St., New York.

Wisconsin Utilities Association—Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

Camp Co-operation IX — Association Island, Henderson Harbor, N. Y., Aug. 2-6. Society for Electrical Development, 600 Graybar Bldg., 420 Lexington Ave., New York.

International Association of Municipal Electricians—Statler Hotel, Boston, Aug. 20-24. H. N. Lang, box 1864, Orlando, Fla.

International Association of Electrical Inspectors, Western Section — Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 9-11. O. A. Weller, Public Service Co. of Colorado, Denver.

New England Division, N.E.L.A. — Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

American Electric Railway Association —Atlantic City, Sept. 28-30. J. W. Welsh, 292 Madison Ave., New York.

WISCONSIN POWER & LIGHT TO BUILD SMALL HYDRO PLANTS.—New construction activities of the Wisconsin Power & Light Company include erection of small hydro generating plants at Rockton, Ill., and Fulton, Wis.

PUBLIC SERVICE COMPANY OF OKLAHOMA TO LAUNCH INDUSTRIAL SURVEY.—The Public Service Company of Oklahoma announces the establishment of a department which will be devoted to industrial development of the territory it serves. This department will make an industrial survey of all towns in which the company operates in an effort to determine their present economic stability and find out what industrial or agricultural development would be of benefit in rounding out a well-balanced community. At the completion of these surveys it is the company's intention to work with local chambers of commerce and other civic organizations in an effort to assist these communities in attracting the type of development for which the community offers particular advantage and inducement.

COST OF MITCHELL DAM.—The Alabama Public Service Commission has ordered the Alabama Power Company to present for investigation all records of power companies absorbed by it, regardless of whether the records are in the United States, England or elsewhere. The authorization was given after the commission had tried unsuccessfully to obtain information substantiating the power company's contention that $3,500,000, estimated as the cost of properties and stock in the companies acquired, should be allocated to the cost of Mitchell Dam. Much of the investigation involved the records of the Alabama Traction Light & Power Company, a holding-company predecessor to the Southeastern Power & Light Company. Mr. Aldridge stated that he understood that the records of this company were in Montreal.

FIVE-YEAR-OLD RATE CASE NEARING AN END IN NEW YORK.—A speedy decision was forecast at the final hearing last week in the rate case of the city of New York against the New York Edison Company when both sides agreed to waive filing of briefs. It was explained that the case had been heard at length before Commissioner Pooley of the Public Service Commission and that the filing of briefs would only cause a further delay in a case which has

lasted five years, it having been instituted in the administration of Mayor Hylan. Counsel for the city decided not to cross-examine representatives of the company on expenditures in installing a high-voltage underground transmission wire between the Hell Gate station of the United Electric Light & Power Company and the Dunwoodie substation of the Yonkers Electric Light & Power Company.

NINE HYDRO PLANTS WITH TOTAL RATING OF NEARLY 500,000 HP. BEING BUILT IN SWITZERLAND.—Nine hydro-electric power stations are at present in course of construction in Switzerland, namely, a 7,000-hp. plant at Ruchlig-Arrau, a 12,000-hp. plant at Etampsee, a 175,000-hp. plant at Dixana, a 120,000-hp. plant at Handeck; one on the Rhine at Ryborg-Schworstadt, the Swiss section being of 67,500 hp.; one at Orsieres of 30,000 hp., one at Sembrancher of 10,000 hp., one at Monte Piottino of 50,000 hp., and an extension of 7,000 hp. at Laufenburg—a total of 478,500 hp.

BLANKET FRANCHISES OBSOLETE IN OREGON.—The former custom in Oregon of granting blanket franchises to public utilities has become an obsolete practice, according to the authorities of many counties who have denied applications for franchises of this character. The last county to refuse permission to a utility to construct lines and operate over any and all highways in the district is Marion. The Molalla Electric Company applied for a blanket form of franchise, but the county has declined to enter into any contract with the utility which would give the operator right-of-way over any highways in group.

TWO YEARS' PROGRESS IN NEW ENGLAND INTERCONNECTION.—Under the auspices of the power industry committee co-operating with the New England Council a map has been prepared of major interconnections in the six Northeastern States as of March 1, 1929. Lines operating at above 15,000 volts are covered. The map shows that since the beginning of 1927 four new interconnections across state lines have been built. These are: Portsmouth, N. H., to Amesbury, Mass.; Woonsocket, R. I., to North Attleboro, Mass.; Westerly, R. I., to Mystic, Conn., and Lancaster, N. H., to Canaan, Vt. An important trunk line will be added with the construction of the link between Fifteen-Mile Falls, in the upper Connecticut Valley, and eastern Massachusetts.

VIRGINIA TOWN BLOCKS INTERCONNECTION, DEMANDING LOWER RATES.—The town of North Tazewell, Va., has obtained an injunction restraining the Tazewell Electric Light & Power Company from connecting its lighting system with that of the Appalachian Electric Power Company until a schedule of rates has been established either by agreement or by the State Corporation Commission. Action was brought because the Appalachian company's system is supplying nearby towns with energy at rates approximately one-half those which the Tazewell company is said to be charging. Unless the Tazewell company agrees to meet the schedule maintained by the Appalachian company, town officials expect to ask the latter company for service, and, failing in that, an attempt may be made to establish a municipal plant.

CENTRAL ILLINOIS COMPANY WINS MYERS AWARD.—The Central Illinois Public Service Company won the L. E. Myers award for accomplishment in the public utility field for 1928, in competition with other companies of the Middle West Utilities system. The citation was made upon the basis of the record of success which the Central Illinois made in all departments during the past year, including voluntary adjustments of rate schedules in nearly all of the 400 towns served by it.

Recent Court Decisions

CITY NOT ENTITLED TO RECOVER SUMS PAID IN EXCESS OF CONTRACT RATE WHEN RATES FIXED BY COMMISSION ARE DISALLOWED.—Crysler Light & Power Company vs. City of Belfield was a suit brought to force the city to pay rates for light and power fixed by the Board of Railroad Commissioners of North Dakota in excess of the contract rates. The city, which had at first paid the increased rates and then refused longer to do so, made a counter claim to recover the sums it had paid in excess of the contract. It was held by the Supreme Court of the state that the order of the commission was null and void, power to change contract rates not having been conferred upon it by the Legislature, and that therefore the company could not collect the sums it sued for. On the other hand, it need not refund the excess payments at first made since the city made them voluntarily, not by mistake or under duress. (224 N.W. 871.)*

ELECTRIC RAILROADS NOT "ELECTRICAL CORPORATIONS" AND NOT SUBJECT TO RATE REGULATION, THOUGH THEY SOLD ENERGY.—The New York Supreme Court, Appellate Division, has sustained the Public Service Commission of the state in disclaiming jurisdiction in a petition filed by the receiver of the Second Avenue Railroad Company of New York City to require the Interborough Rapid Transit Company and the New York Railways Corporation to furnish him with electrical service at a "just and equitable charge," the complaint being made that the rates charged the petitioner were not such. The single question presented was whether the railroad respondents are electrical corporations within the meaning of the public service law. The Supreme Court held that they were not, one judge out of four vigorously dissenting on the ground that railroad corporations should not be allowed to exploit purchasers of power without restriction or to compete without restriction with corporations which have only one function—to generate and sell electricity. (234 N. Y. S. 174.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

VERMONT COMMISSION ORDERS UNIFORM CLASSIFICATION OF ACCOUNTS.—The Vermont Public Service Commission has issued an order to all electric, common-carrier and gas utilities to adopt the uniform classification of accounts which was recommended by the National Association of Railroad and Utilities Commissioners. The system was formulated for the use of all electric companies subject to the supervision of a public service commission and having an annual operating revenue of more than $10,000.

CAN COMMISSION PREVENT MUNICIPAL PLANT FROM CHARGING RATES LESS THAN COST OF SERVICE?—Dismissing a protest from the Niagara, Lockport & Ontario Power Corporation against a general reduction of electric rates by the Jamestown (N. Y.) municipal plant, the Public Service Commission of New York said: "The city calls attention to the fact that in a case involving the determination of just and reasonable rates the authority of the commission seems to be limited to the fixation of maximum rates which may be charged by a municipality furnishing electric service. This contention appears to be conceded by the Niagara, Lockport & Ontario Power Corporation, which, however, contends that under the public service commission law the commission has jurisdiction when the rates charged or proposed to be charged by the city are less than cost. . . . It is the contention of the company that the rates charged and proposed to be charged by the city, being less than cost, constitute a violation of the city charter . . . and hence the commission has jurisdiction to investigate and prescribe just and reasonable rates. Such argument, however, overlooks the fact that it is not every violation of law over which the Public Service Commission has jurisdiction. While it is probable that the violation of law asserted in this case does not come within the purview of the general laws, . . . it is unnecessary to decide that question here, for even if the commission should, after an investigation, determine that the rates charged or proposed to be charged by the city in effect violate the provisions of the charter and therefore constitute a violation of a provision of law, any substitute rate or charge prescribed by the commission as just and reasonable thereafter to be charged would, under the public service commission law, be maximum only, and no power appears to have been lodged in the commission to enforce the collection of maximum charges or to prohibit action by the city making lower rates effective. It would seem in these circumstances that the question might better be determined in an appropriate taxpayers' action." An appeal by the company against this decision, on the grounds that the rates in question are unjust, unduly discriminatory and in violation of law, and that the commission erred in deciding it had no jurisdiction to entertain the original complaint of the company, was dismissed.

News About Men of the Industry

William S. Barstow Honored at Testimonial Dinner

A testimonial dinner and reception was tendered to William Slocum Barstow in honor of his many years of successful endeavor and accomplishment in the electric light and power field by Frederick Strauss, of J. & W. Seligman & Company, and Harold T. White, of White, Weld & Company, at the University Club, New York City, Wednesday evening, June 12. The council room of the University Club was elaborately decorated for the occasion. The table was arranged in an extremely unique fashion, having set in the center a miniature reproduction of the first electric light plant erected by Mr. Barstow, some 30 years ago in Brooklyn, N. Y., when he was general manager of the Edison Electric Illuminating Company of Brooklyn.

After Mr. Strauss, Mr. White and Mr. Barstow had addressed the guests a curtain was pulled aside and a reproduction, 6x12 ft., was shown in a beautiful night setting of a modern plant recently erected by Mr. Barstow. The old plant then was shut down. During the dinner each guest was called upon to state some of his experiences while associated with Mr. Barstow, or while a stockholder of W. S. Barstow & Company, and many facts were brought out as to the progress of the art and the financing of the industry for the past 40 years. During the dinner Mr. Strauss and Mr. White presented to Mr. Barstow a gold traveling clock, properly inscribed.

J. S. AVERY, formerly connected with the W. S. Barstow organization, is now vice-president and general manager of the Staten Island Edison Company.

THOMAS A. EDISON returned to his home in West Orange, N. J., this week from Fort Myers, Fla., where he had been vacationing since January.

LEWIS TAYLOR ROBINSON, engineer in charge of the general engineering laboratory of the General Electric Company, was the recipient of the honorary degree of doctor of science at the recent annual commencement exercises of Union College, Schenectady. Mr. Robinson is a fellow of the A.I.E.E. and twice held the office of vice-president of that society, as well as the chairmanship of the standards committee, in 1919-1920. He is a fellow of the American Physical Society and a member of the American Association for the Advancement of Science, the National Electrical Manufacturers' Association, the Society of Engineers of Eastern New York and other similar organizations.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, was made the recipient of the honorary degree of doctor of laws by Hamilton College at the commencement exercises held June 17.

DEXTER S. KIMBALL, dean of the College of Engineering of Cornell University, has been elected a member of the board of directors of the McGraw-Hill Publishing Company, publisher of the ELECTRICAL WORLD.

PROFESSOR PARKER H. DAGGETT, head of the department of electrical engineering at the University of North Carolina, was named dean of the Engineering School of Rutgers University at an executive committee meeting of the Rutgers board of trustees May 24. Professor Daggett will succeed Professor Edward H. Rockwell, resigned.

ALBA H. WARREN, formerly manager of the Southeastern district of Stone & Webster, Inc., with headquarters at Savannah, Ga., has resigned to become vice-president and general manager of the Houston Gas & Fuel Company and he is now located at Houston, Tex. In the course of his connection with the Stone & Webster organization Mr. Warren served with the properties at Houghton, Mich.; Plymouth, Mass.; Pensacola, Fla.; Galveston and El Paso, Tex., and finally at Savannah, Ga.

L. F. Seybold Named Research Engineer

Lawrence F. Seybold, for the past ten years connected with the Milwaukee Electric Railway & Light Company, has been appointed research engineer to succeed Ralph E. Moody, who has assumed new executive duties. Mr. Seybold, a native of Forest Junction, Wis., attended the University of Wisconsin, graduating in electrical engineering in 1918. He enlisted in the navy in April of that year and after a course at a naval officers' training school at Hoboken, N. J., served until January, 1919, holding the rank of ensign upon discharge. He affiliated himself with the Milwaukee utility in the spring of 1919, as a junior engineer in the operating research bureau. He is now head of that bureau, in charge of engineering and economic research work related to the company's business.

W. H. Burke Heads Minnesota Utility

Walter H. Burke, for many years connected with the Stone & Webster organization, has been named president and general manager of the Minnesota Power & Light Company to succeed W. S. Robertson, resigned. The name of Walter Burke is familiar to utility men throughout the country, for in the course of his public utility career he has served in engineering capacities in various sections. He started with Stone & Webster in the Boston office, subsequently removed to Dallas, Tex., later to Houghton, Mich., and then to Keokuk, Iowa, holding managerial positions with all these properties. He returned to Texas to take charge of the Northern Texas Traction Company and the Tarrant County Traction Company, and it was after this connection that he assumed the broader duties of Southwestern district manager, comprising the plants in Texas, Louisiana, New Mexico and Mexico with headquarters in Houston. He spent some time in the Boston office of Stone & Webster, Inc., before affiliating himself with the Electric Bond & Share Company as president and general manager of the Minnesota Power & Light Company.

Mr. Burke is a graduate of the University of Maine and he was connected with the General Electric Company for a short time before entering the public utility field. He was identified with Stone & Webster continuously with the exception of a short connection with the Milwaukee Electric Railway & Light Company.

E. HERZOG has resigned as research engineer of the General Electric Company at West Lynn, Mass., to become electrical testing engineer with the State Line Generating Company at Hammond, Ind., in charge of the electrical testing section of the operating department.

ROBERT A. MILLIKAN, physicist, was made the recipient of the honorary degree of doctor of science by New York University at the recent commencement exercises. The citation said in part: "Recognized by many institutions of learning as a foremost leader in scientific research; a son of the manse, whose discoveries in the physical world have not blinded him to spiritual realities. . . . Institutions of learning throughout the world have gladly acknowledged the immeasurable value of your contribution to science."

F. O. Dolson General Manager of California Utilities

F. O. Dolson, formerly assistant general manager, has been appointed general manager of the Southern Sierras Power Company, the Nevada-California Power Company and the Yuma Utilities Company, succeeding A. B. West, recently named president and general manager of the Nevada-California Electric Corporation, as announced in the June 1 issue of the ELECTRICAL WORLD.

Mr. Dolson entered the employ of the organization in 1914 as inspector on the construction of the Imperial Valley line, and at the conclusion of that work was placed in charge of hydro plants on Bishop Creek. During 1916-17, in addition to the supervision of hydro plant operation, he supervised the construction of the Rush Creek plant. In 1918 he was transferred to Riverside as general superintendent of the entire electrical system of the associated companies, and four years later was elected vice-president of those companies. His appointment as assistant general manager followed in September, 1922.

F. E. Bonner Executive Secretary Power Commission

Frank E. Bonner, who was named executive secretary of the Federal Power Commission to succeed Oscar C. Merrill, as announced in the June 8 issue of the ELECTRICAL WORLD, has engaged in engineering work for the government for a number of years. For the past seven years he has been district engineer of the Forest Service in California and has been the representative of the Power Commission in that state, which has furnished three-fourths of all applications under the water-power act. His duties there involved the supervision of several of the largest public utility hydro-electric developments in the United States, including the construction of many dams of major size. He has served on various technical boards and commissions, including the San Gabriel River Commission, the St. Francis Dam Investigation Board and the California Water Resources Advisory Board. He is the author of a recent bulletin which presents a comprehensive plan for the development of the water-power resources of California and has at various times contributed articles to the technical press.

Mr. Bonner received his technical education at the University of Montana. Last year he was awarded an honorary master of engineering degree by that institution.

E. G. STAHL, since November, 1928, agricultural engineer for the San Joaquin Light & Power Corporation, Fresno, Calif., has been named to succeed A. M. Frost as sales manager of that company. Mr. Stahl brings to the position the benefit of ten years' specialization in rural electric problems and the application of power to agriculture. Growing up in a farming community, he attended Kansas State University and was graduated as an electrical engineer. He joined the power company's organization as district manager at Los Banos in 1919, two years later being transferred to San Joaquin as manager of that district, a position he held for seven years until transferred to Fresno.

R. E. Moody Assumes New Duties in Milwaukee

Ralph E. Moody, formerly research engineer of the Milwaukee Electric Railway & Light Company, has been appointed executive assistant of that company, to succeed W. F. Persons, resigned. Mr. Moody is a native of Milwaukee and a graduate of the University of Wisconsin in electrical engineering. Following graduation he entered the employ of the Milwaukee utility, advancing from minor positions to assistant research engineer in 1919. In 1920 he was named research engineer.

CHARLES M. BREITINGER and CLIFFORD WINNER have been elected assistant treasurers of the Philadelphia Electric Company, according to an announcement made by William H. Taylor, president. Mr. Breitinger is also assistant controller of the Philadelphia Electric Company and assistant secretary and assistant treasurer of a number of its subsidiaries. He is a former chairman of the Accounting National Section of the National Electric Light Association. Mr. Winner became identified with the Philadelphia Electric Company early this year and was formerly connected with the Philadelphia Suburban Counties Gas & Electric Company.

WILLIAM CABELL BRUCE, formerly United States Senator from Maryland, has been appointed general counsel to the Maryland Public Service Commission and JOHN N. LEWIN, another prominent Baltimore lawyer and formerly assistant city solicitor, has been named people's counsel. RAYMOND S. WILLIAMS of Baltimore, who has been serving as special counsel, will continue in that capacity until the cases in which he has taken part are finally concluded. Mr. Bruce was general counsel to the commission from 1910, when the body was established, until 1922, when he resigned to become a candidate for the United States Senate. The office was abolished later, but was re-established a few years ago. Since that time, however, no appointment was made until Mr. Bruce was named. Mr. Lewin will succeed Thomas J. Tingley, who has resigned as people's counsel, effective July 1.

CLARK BELDEN, executive vice-president and a director of the Connecticut Chamber of Commerce, has resigned to become public relations director of the National Electric Power Company. The change is effective June 15. Mr. Belden matriculated at Brown, Cornell and Northwestern Universities. He was formerly connected with the advertising and publicity departments of the Travelers, Aetna Life and Hartford Fire Insurance Companies, Hartford, Conn.

FRANCIS P. MOONEY, vice-president in charge of purchases of Charles H. Tenney & Company, has resigned after an association which covers a period of almost 30 years. Mr. Mooney became purchasing agent of the Malden Electric Company in 1901 and when Charles H. Tenney & Company was incorporated, in 1912, he became its purchasing agent. In recognition of the value of his services he was appointed vice-president in charge of purchases in 1920.

A. F. VAN DEINSE, president and general manager of the Columbus, Delaware & Marion Electric Company, has resigned because of ill health. His resignation is effective July 1. Mr. Van Deinse will be succeeded by WILLIAM P. MOLONEY as president and L. C. STANG as vice-president and general manager. Mr. Van Deinse has been with the company for eleven years, Mr. Moloney has served as general counsel and a member of the board of directors since 1904 and Mr. Stang has been with the company ten years. Mr. Stang is now serving as superintendent of the electrical department.

Obituary

DAVID A. REED, manager of the city water and light department of Duluth, Minn., since 1913, died at his home in that city June 12 after a long illness. Mr. Reed was a resident engineer for the Soo Line when it built its road into Duluth, and also was a former Duluth city engineer. He was 70 years of age.

WILLIAM S. HALLOWELL, for nearly half a century an officer of the Cochrane Corporation and its predecessor, the Harrison Safety Boiler Works, died at his home in Germantown, Philadelphia, June 2. He was actively associated with the introduction of the Harrison safety boiler and the Cochrane open heater, and at the time of his retirement a few years ago was secretary and treasurer of the Cochrane Corporation.

Financial and Statistical News

COMPLETION THIS WEEK of the merger of up-state New York utilities into the Niagara Hudson Power Corporation under the auspices of J. P. Morgan & Company is the major factor affecting the markets. Under the leadership of the merger stocks the utilities have again featured trading activities and many of the common stocks have advanced several points, whether in any way connected with the merging companies or not.

——SUBSTANTIAL GAINS WERE MADE by several of the utility stocks apart from Mohawk Hudson Power, Northeastern Power and Buffalo, Niagara & Eastern. Examples were Electric Bond & Share, Standard Gas & Electric, American Water Works and several other issues. Rumors that Consolidated Gas, Electric Light & Power Company of Baltimore was in some way associated with the merger caused this stock to spurt several points upward. For the same reason, Consolidated Gas of New York was also buoyant, touching a new high.

——THE ELECTRIC MANUFACTURING COMPANY STOCKS were also firm and active on news of the merger. Westinghouse and General Electric both reached new high levels and Allis-Chalmers gained several points.

——SPECULATORS FOR THE RISE have had the upper hand this week, generally speaking.

Insull Companies to Issue Rights

Directors of the Commonwealth Edison Company and the Public Service Company of Northern Illinois, both of which are in the Insull group of public utilities, have applied to the Illinois Commerce Commission for permission to issue additional stock which will be offered to stockholders at par later in the year. The rights are valued at more than $35,000,000.

According to the plan now under way the Commonwealth Edison Company is to increase outstanding stock 12½ per cent and sell to stockholders one additional share at $100 for each eight shares held. The shares are selling at approximately 261, at which figure the rights would amount to $22,593,044. The Public Service Company of Northern Illinois proposal is to issue additional no-par common stock to the extent of 16⅔ per cent of its outstanding stock of all classes, stockholders to take one additional share at $100 for each six shares held. With the current market price of the stocks around 254, the rights would be worth $12,435,874.

Healthy Growth in Canada

There was a general seasonal reduction in the output of central electric stations in the five economic areas of Canada during the month of April, but a rise of 11 per cent compared with April, 1928, according to the Dominion Bureau of Statistics. The total output for the month was 1,409,103,000 kw.-hr.; in the preceding month it was 1,470,520,000 kw.-hr. and in the same month last year 1,271,938,000 kw.-hr.

For the first four months of the current year central electric station output amounted to 5,733,275,000 kw.-hr., of which 5,612,763,000 came from water power and 120,512,000 from fuel. For the same period of 1928 output amounted to 5,223,062,000 kw.-hr., made up of 5,149,880,000 generated by water power and 73,183,000 generated by fuel.

The average daily output, 46,970,000 kw.-hr., was only 1 per cent less than in March, with 47,436,000 kw.-hr. The average daily export of power from central electric stations in April last totaled 3,690,000 kw.-hr., or 395,000 less than in the preceding month. In April, 1928, it was 4,072,000 kw.-hr., roughly the same as in March, 1929.

Insull Interests Organize New Unit

The Seaboard Public Service Company has been organized as a subsidiary of the National Public Service Company, one of the Insull utility holding companies, to assume control of the operating companies in Maryland, Delaware, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida. The constituent companies of the new organization are the Eastern Shore Public Service Company, Virginia Public Service Company, Tide Water Power Company, Georgia Power & Light Company, Florida West Coast Ice Company and the Florida Power Corporation. These various companies serve a population of 621,000 in 514 communities, with 125,393 customers, of which 113,243 are electric customers, 11,658 gas and 480 water. The capital of the new company consists of 150,000 shares of $6 cumulative preferred stock, of which 50,000 shares are outstanding, and 750,000 common shares, of which 600,000 are outstanding, all of no par value.

Foreign Power Securities Issues Bonds

Twenty-year first collateral trust convertible bonds, series A, of the Foreign Power Securities Corporation were offered the investing public at 100 and accrued interest to yield 6 per cent, a piece of financing involving a total of $5,000,000. These bonds, dated June 1, 1929, will mature June 1, 1949.

The Foreign Power Securities Corporation, Limited, was incorporated in 1927 under the laws of the Dominion of Canada and is primarily interested in the acquisition of the securities of hydro-electric and public utility companies operating in foreign countries. These bonds are convertible into the common shares of the corporation. Proceeds from the sale will be used to retire loans incurred in the acquisition of the shares of public utility companies of France recently purchased, to provide funds for further investment and for other corporate purposes.

Toho Electric Power Again Enters American Market

The Toho Electric Power Company (Toho Denryoku Kabushiki Kaisha), which is now familiar to the American investing public, entered the American market again this week with an offering of three-year 6 per cent gold notes, amounting to $11,450,000, the price being 96¼ and accrued interest to yield over 7.40 per cent. The proceeds of these notes, together with cash now on hand, are to be used to pay the entire existing bank indebtedness of the company and approximately $10,432,717 of its funded debt (maturing or to be retired by sinking funds during 1929) and for other corporate purposes.

The company owns 44 electric generating stations, with an aggregate installed capacity of 228,658 kw., and controls an additional 159,500 kw. under contracts with eight neighboring hydro-electric companies and one farmers' association.

Sharp Rise in Energy Output

Exceeding the production of April, 1928, by 1,000,000,000 kw.-hr., or 15 per cent, the output of public utility power plants in April of this year showed the largest rise thus far recorded for any month over the corresponding one of 1928. The total production as reported by the U. S. Geological Survey was 7,874,191,000 kw.-hr., as against 7,984,014,000 kw.-hr. in March. While the monthly production was lower, the aver-

age daily production was about 2 per cent over the average daily rate for March. Such a rise in April is unusual and indicates a high rate of industrial activity.

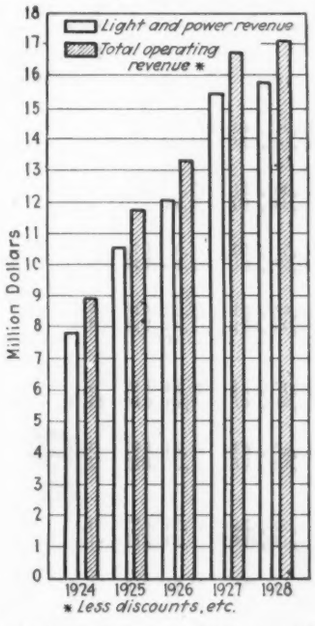
This total includes the output of electric railway plants and certain others supplying energy for public use, in addition to central stations. When separate figures for central stations become available the rise for these alone will probably prove to be somewhat greater than 15 per cent.

The production of electricity by the use of water power has recovered from its slump of the last few months and has about returned to normal, constituting 42 per cent of the total.

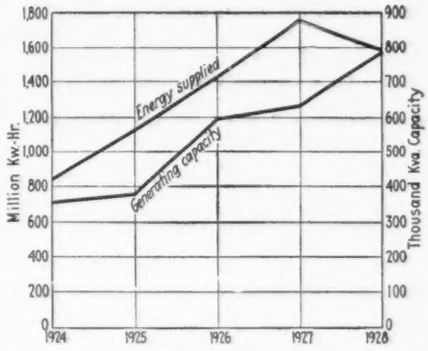
Alabama Power Costs Cut; Net Up 15 per Cent

NINETEEN - TWENTY - EIGHT was a decidedly successful year for the Alabama Power Company in several respects. It represents the first full year's operation as a consolidated system. It marked an advance in earnings and construction, a drop in operating ratio and a general domestic rate reduction.

Late in 1927 Alabama Power, Gulf Electric and Houston Power Companies were merged and a comprehensive construction program was completed. Rapid industrial expansion in the area served has necessitated a steady program of new construction and development of hydro and steam reserve generating capacity. The system now has seven hydro and four major steam generating plants as well as eleven small secondary steam plants with a total installed capacity of 645,435 hp., and in addition it has available, under satisfactory working agreements, 296,610 hp. in plants belonging to others. Its 27 primary substations of 968,050 kva. capacity and 6,352 miles of transmission and distribution lines serve 421 communities in 61 of the 67 counties in Alabama, an area of approximately 40,000 square miles, with an estimated population of 1,700,000.



Comparison Between Light and Power Revenue and Total Revenue



Some Operating Statistics of Alabama Power Company

One feature of the company's growth is the aggressive encouragement of new industries. During the past year nineteen major industries were established in 24 Alabama communities served by the company, involving 38 plants, with an estimated initial power requirement of 27,000 hp. and an ultimate demand within the next five years of 60,000 hp. The company's activities were largely responsible for the establishment of these plants. Electric service was extended during the year to 71 additional communities and 7,513 new customers.

The new rate schedule for domestic service promulgated by the Alabama Public Service Commission on December 31, 1928, reduces the cost of service to consumers more than $300,000 yearly.

During the year there was a material reduction in operating expenses, brought about by unusually heavy and evenly distributed rainfall, with a resulting reduction in steam generation, and increased efficiencies made possible by further interconnections and co-ordination of the consolidating companies.

Gross earning last year totaled $17,111,032, of which 93 per cent was electric. Operating costs during the year showed an actual reduction of $871,871 to $7,832,816. Net operating earnings increased from $8,059,386 to $9,278,215, a growth of more than 15 per cent.

CENTRAL STATES ELECTRIC DECLARES STOCK DIVIDEND.—This corporation has declared a 200 per cent stock dividend, payable July 25 in common stock to common-stock holders of record at the close of business July 15, 1929. Net income after expenses, interest and taxes and including stock dividends at their approximate market value amounted to $6,283,260 for the five months ended May 31, 1929, as compared with $1,608,947 for the same period in 1928.

PEOPLES LIGHT & POWER ADDS TO DIRECTORATE.—Ellery James of Brown Brothers & Company and H. B. Pennell, Jr., of Coffin & Burr, Inc., have been elected directors of Peoples Light & Power Corporation.

ELECTRIC POWER ASSOCIATES GIVES RIGHTS.—Directors of Electric Power Associates, Inc., have voted to give common-stock holders of record of July 1 the right to subscribe to one share of non-voting class A stock at $40 for each share of common held. Rights to subscribe will expire July 15. Subscriptions may be in full or $20 at the time of subscription and $20 September 16, with interest for the period between July 15 and September 16 at the rate of 6 per cent a year.

ELECTRIC BOND & SHARE DECLARES DIVIDEND.—An initial dividend at the annual rate of 6 per cent in stock has been declared by the directors of the Electric Bond & Share Company, who announced a quarterly dividend of 3/200 of a share of common stock of the company to each share of common outstanding. Holders of certificates for common stock of the Electric Bond & Share Securities Corporation are to be treated for the purpose of this dividend as holders of the number of shares of the Electric Bond & Share Company which they will be entitled to receive upon surrender of such certificates.

EXCHANGE BASIS ANNOUNCED FOR U. G. I. AND ERIE COUNTY STOCK.—The United Gas Improvement Company is offering two of its shares of capital stock (par $50) for each share of capital stock of the Erie County Electric Company (par $100). U. G. I. has recently purchased a majority of the capital stock of the Erie County organization, which has been under the supervision of the U. G. I. since March, 1928. The exchange of stock is subject to the approval of the Public Service Commission. In the agreement the United Gas Improvement Company offers to acquire the balance of the outstanding stock of the Erie company on the same terms.

ASSOCIATED GAS & ELECTRIC GIVES RIGHTS.—The Associated Gas & Electric Company will soon mail to holders of its class A and common stocks rights to subscribe for one share of class A stock at $42 a share for each four shares held at the close of business on June 14.

RECENT LISTINGS.—The New York Stock Exchange committee on stock listings has approved the listing of 433,134 additional class "A" and 170,000 additional class "B" common shares of the General Gas & Electric Corporation, to permit the class "A" stockholders to

apply their cash dividends to the acquisition of additional class "A" stock, to allow for the sale of additional class "A" stock to class "A" stockholders in the ratio of 33⅓ per cent of their holdings and to provide for the sale of 170,000 class "B" shares at $95 a share to Associated Gas & Electric interests. Approval was also given for the listing of the Unterelbe Power & Light Company's twenty-five year 6 per cent sinking fund mortgage gold bonds, series "A," to the amount of $4,940,000,000.

New Capital Issues

Central Power & Light Company First Mortgage Gold Bonds.

Amount, $6,800,000.
Price, $91 and accrued interest, to yield 5.65 per cent.
Date of maturity, 1956.

Central Power & Light Company supplies public utility service to a group of 151 communities located in the southern part of Texas. These bonds are a direct obligation of the company and are secured by an absolute first mortgage on all of the permanent property, rights and franchises of the company now owned and on all property hereafter acquired.

Western Power, Light & Telephone Company First Lien Collateral Gold Bonds.

Amount, $1,187,000.
Price, $97½ and interest, yielding about 6.20 per cent.
Date of maturity, 1948.

Western Power, Light & Telephone Company owns subsidiary companies which own and operate a group of public utility properties in Missouri, Kansas, Oklahoma and Texas. These bonds are a direct obligation of the company and are secured by first lien on all outstanding capital stocks (except directors' qualifying shares) and all outstanding funded debt of pledged subsidiaries.

Intercontinents Power Company Cumulative Preferred Stock.

Amount, 15,000 shares.
Price, $99 per share flat, to yield 7.07 per cent.
Warrant feature, class A common stock, purchase warrants attached.

Intercontinents Power Company was organized to acquire, operate and participate in the ownership of public utility properties in South America and other countries. The cost of the properties owned and under contract, together with working capital and cash to be available after present financing for the purchase of additional properties and other capital expenditures, is in excess of $12,800,000. A warrant detachable after December 1, 1929, will be attached to each permanent certificate, entitling the holder to purchase in the ratio of three shares of class A common stock of the company for each share of preferred stock at $25 per share until December 31, 1930; at $27.50 per share until December 31, 1932, and at $30 per share until December 31, 1933.

LUZERNE COUNTY UTILITY TO RECAPITALIZE.—Directors of the Luzerne County Gas & Electric Corporation have called a special meeting of stockholders for August 7 to vote upon a plan of recapitalization.

AMERICAN COMMONWEALTHS POWER DECLARES DIVIDENDS.—Directors of the American Commonwealths Power Corporation have declared initial dividends of 15 cents on the class A and class B common, payable July 15 to stock of record July 1. A stock dividend of 1/40 of a share of class A common stock was also declared on both issues, payable October 15 to stock of record October 1. The company also declared regular quarterly dividends of $1.62½ on $6.50 first preferred and $1.75 on $7 first preferred, series A, both payable August 1 to stock of record July 15.

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
American Power & Light & Subs. (Year ended March 31)					
Gross earnings	$84,193,389	$63,845,571	31.8	49	54
Net earnings	42,546,198	29,202,701	45.5	..	..
American Water Works & Electric & Subs. (Year ended April 30)					
Gross earnings	51,794,332	49,356,403	4.7	50	53
Gross income	25,594,032	23,262,980	6.0	..	..
Associated Gas & Electric System (Year ended March 31)					
Gross earnings	50,090,053	40,525,236	24.0	55	55
Net earnings	27,535,247	22,514,317	22.0	..	..
Carolina Power & Light (Year ended April 30)					
Gross earnings	9,166,301	8,956,076	2.0	46	53
Net earnings	4,906,946	4,203,050	17.0	..	..
Commonwealth Power (Year ended April 30)					
Gross earnings	60,475,445	54,802,502	10.4	51	53
Gross income	29,400,572	25,755,946	14.2	..	..
Consumers Power (Year ended April 30)					
Gross earnings	31,777,147	27,825,318	14.2	49	51
Gross income	16,113,792	13,611,874	18.4	..	..
Eastern Texas Electric & Subs. (Year ended April 30)					
Gross revenue	8,592,180	7,398,578	16.1	..	..
Net revenue	3,573,263	2,702,884	32.2	..	..
Eastern Utilities Associates & Subs. (Year ended April 30)					
Gross revenue	8,844,171	8,360,666	5.8	..	..
Net revenue	3,434,879	3,008,430	14.2	..	..
Electric Power & Light & Subs. (Year ended March 31)					
Gross earnings	55,779,866	53,154,175	4.9	53	54
Net earnings	26,316,051	24,085,107	9.3	..	..
Engineers Public Service & Subs. (Year ended April 30)					
Gross earnings	39,277,328	30,068,714	30.6	58	61
Net earnings	16,547,977	11,756,654	40.8	..	..
Federal Light & Traction & Subs. (Year ended April 30)					
Gross earnings	8,169,951	7,255,659	12.6	59	61
Net earnings	3,348,080	2,772,795	20.7	..	..
Galveston-Houston Electric & Subs. (Year ended April 30)					
Gross earnings	5,256,439	5,170,956	1.6	..	..
Net earnings	1,711,453	1,671,992	2.4	..	..

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Illinois Power & Light & Subs. (Year ended April 30)					
Gross earnings	$35,957,345	$31,928,674	12.6	56	59
Net earnings	15,645,504	12,950,397	20.7	..	..
Kansas City Power & Light (Year ended April 30)					
Gross earnings	14,041,951	13,153,251	6.8	51	51
Net earnings	6,854,560	6,428,928	6.6	..	..
Nebraska Power (Year ended April 30)					
Gross earnings	5,517,110	5,011,038	10.0	51	52
Net earnings	2,675,661	2,384,909	12.0	..	..
Nevada-California Electric & Subs. (Year ended April 30)					
Gross earnings	5,521,105	5,275,426	4.6	46	43
Net earnings	2,982,506	2,981,965	0.0	..	..
Penn-Ohio Edison and Northern Ohio Power (Year ended April 30)					
Gross earnings	28,370,674	26,643,580	6.5	60	63
Gross income	11,410,847	9,901,684	15.2	..	..
Portland Electric Power (Year ended April 30)					
Gross earnings	12,620,269	12,248,892	3.0	60	59
Gross income	5,127,797	5,012,825	2.3	..	..
Puget Sound Power & Light & Subs. (Year ended April 30)					
Gross earnings	15,505,676	14,952,635	3.7	..	..
Net earnings	6,426,418	6,508,771	—1.3	..	..
Southern California Edison (Year ended April 30)					
Gross earnings	36,801,481	31,841,267	16.0	34	33
Net income	24,101,968	21,377,043	13.0	..	..
Tennessee Electric Power (Year ended April 30)					
Gross earnings	13,712,553	12,783,286	7.3	51	54
Net earnings	6,703,706	5,826,593	15.1	..	..
Texas Power & Light (Year ended April 30)					
Gross earnings	9,581,802	9,451,485	1.0	50	56
Net earnings	4,757,231	4,174,860	14.0	..	..
United Light & Power & Subs. (Year ended April 30)					
Gross earnings	91,071,476	86,048,587	5.8	58	61
Net earnings	38,037,090	33,358,547	14.0	..	..
Utah Power & Light (Year ended April 30)					
Gross earnings	11,291,114	10,693,651	6.0	49	49
Net earnings	5,789,017	5,471,469	5.0	..	..
Virginia Electric & Power & Subs. (Year ended April 30)					
Gross earnings	16,539,503	15,707,289	5.3	..	..
Net earnings	7,305,797	6,466,483	12.9	..	..

Business News and Market Conditions

Data to Be Collected on Refrigerator Sales

Quarterly surveys of stocks and sales of electrical refrigerators will be made by the electrical division of the Bureau of Foreign and Domestic Commerce, at the request of the National Electrical Manufacturers' Association, it was announced by the Department of Commerce, the first inquiry either to be made October 1 next, covering the second quarter of the year, or on January 1, 1930, covering 1929 sales.

Lamp Sales Show Record Year for 1928

In its final serial report for the year 1928-1929 the lamp committee of the National Electric Light Association reports a record year in the sale of large tungsten filament lamps for 1928. The rate of increase, while not as high as it was for 1927, is held to be of more significance to the American lamp manufacturers, as it represents a much smaller importation of foreign lamps.

"During 1928," says the report, "a total of 312,000,000 large tungsten filament lamps were sold in the United States. This is the greatest number of lamps ever sold in any one year and is an increase of 2.3 per cent over the previous year, as compared with 3.7 per cent increase of 1927 over 1926. In addition, 9,900,000 large carbon lamps were sold in 1928, as compared with 12,600,000 sold in 1927, a decrease of 21.4 per cent. The majority of these carbon lamps (77 per cent) were imported.

The total sales of large carbon lamps during the past three years have decreased, due to the decrease in importations, the sales of domestic-made large carbon lamps having remained about constant. Most of these imported carbon lamps have been sold through chain stores, which are now selling tungsten filament lamps in greatly increasing quantities.

Orders for Electrical Goods Show Rise for First Quarter

New orders booked during the first quarter of 1929, as reported to the Department of Commerce by 81 manufacturers of electrical goods, were $321,732,414, as compared with $282,226,449, for the last quarter of 1928 and $237,508,001 for the first quarter of 1928. The following totals of bookings for each quarter since the beginning of 1924 are presented as probably sufficiently representative to indicate the trend:

Orders for Electrical Goods

Quarter	1924	1925	1926	1927	1928	1929
First	$221,687,030	$227,767,511	$255,917,883	$235,883,303	$237,508,001	$321,732,414
Second	216,637,855	222,056,450	240,855,953	229,353,332	245,520,801	.....
Third	181,160,835	225,184,732	233,873,171	228,610,346	264,466,257	.....
Fourth	225,070,111	237,225,521	251,442,991	232,877,670	*282,226,449	.....
Total	$844,555,831	$912,234,214	$982,089,998	$926,724,651	1,029,721,508	.....

* Revised.

Recent Phases of European Recovery*

By Dr. Julius Klein

ECONOMIC events of truly major significance continue to crowd the front pages of our dailies. From the point of view of European stabilization the outstanding recent episodes have been the coming of the Labor party into power in England and the settlement of the reparations question.

The first of these is fraught with widespread economic significance. It seems to be the general conclusion that the new Labor government will promptly undertake more aggressive moves in the attempted solution of the unemployment problem and that its program in this connection will consist of more active governmental participation in some of the distressed industries. . . .

Judging from pre-election statements of Mr. MacDonald and his associates there is not likely to be any reversal of the present British tariff policy. Labor seems to have been quite effectively "sold" on the idea that the so-called "safeguarding" policy has been decidedly helpful. . . .

German employers have naturally been reluctant to make any upward adjustment of wages because of the increasing competition that confronts German industry in world markets. On the other hand the workers are suffering from the growing pressure of the rising living costs. . . .

An interesting phase of the European financial recovery has been the advance of French capital in the international field. In pre-war years the French investment in Russia exceeded 2.3 billion dollars. This has been largely wiped out, but the persistent frugality which is typified among the French peasantry is again asserting itself and large amounts of French capital are now finding their way to lucrative Continental openings. . . .

In some instances these French financial activities are presenting unexpected problems to American exporters because of the control which the French thus exercise over distribution. . . .

Sweden is also beginning to figure in certain financial operations, largely through the agency of the powerful Swedish match trust. This organization has undertaken an interesting series of loans to small governments in exchange for the monopoly of the match trade. . . .

European bankers still use the old device of interlocking directorates to swing the expenditure of the proceeds of foreign loans to industries closely associated with the bank floating the said loans. This plan of operation, which was typical of pre-war export strategy in Germany, is again manifesting itself, especially in British operations. . . .

One increasingly potent factor in European recovery is the international cartel, the possibilities of which are still being exploited. The chief purpose of such cartels is, of course, the elimination of destructive competition.

Incidentally, Belgium seems to be more and more the center of cartel activity. . . .

Colonial markets are featuring to an increasing extent in the program of trade rehabilitation throughout Europe. . . .

Still another significant indicator of European recovery is the continued rapid expansion of the merchant marines of the nations. . . .

One of the best indices of the industrial recovery on the Continent is the impressive growth in recent months of the iron and steel industry. . . .

**From an address before members of the McGraw-Hill staff.*

Activity in Lead Features Non-Ferrous Metal Markets

The largest volume of lead sales in the last two weeks indicates the resistance of a moderate buying wave in that market. Otherwise, a state of unusual quiet has prevailed. With the exception of a slight stiffening in quotation for prime Western zinc, prices continue unchanged, but firm. The expected improvement in demand for copper failed to materialize again last week. In the domestic market sales were appreciably less than in the preceding week, partly as a result of the failure of primary producers to make such large sales of special shapes for prompt delivery as in the week ended June 12. All business has been on the basis of 18 cents delivered Connecticut Valley, however, and there is no indication of weakness in that price.

NEW YORK METAL MARKET PRICES

	June 12, 1929 Cents per Pound	June 19, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	7.00	7.00
Antimony	8.875	8.875
Nickel, ingot	35	35
Zinc, spot	6.988	7.038
Tin, Straits	44.125	44.625
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price June 19, 1929, 19¼ cents.

Market Conditions

NO EVIDENCE of a midsummer lull in the electrical equipment business has yet appeared. Although individual orders throughout the Eastern district are small, the total volume is satisfactory.

——SUBSTANTIAL ORDERS FOR SWITCHING EQUIPMENT AND TRANSFORMERS are pending in the Southeast and the existing volume of business is about normal for this season.

——ORDERS FOR SMALL MOTORS AND CONTROL EQUIPMENT are outstanding in the business done in New England this week.

——THE LARGE VOLUME OF STOCK SIZES OF ALL LEADING APPARATUS is a notable feature of St. Louis district business. In the Middle West circuit revision work has been active.

——POWER COMPANY EQUIPMENT IS MOVING ACTIVELY on the Pacific Coast, where construction has been exceedingly active.

EASTERN DISTRICT

Small order account is a feature of the market in the Eastern district. The demand is rather widely scattered over the general industrial field. Power companies and railroads are sharing in the call. A leading manufacturer of light and heavy electrical equipment reports small-order business averaging from $400,000 to $500,000 weekly at the present time. Another maker of apparatus for contractors states that there is an excellent volume demand for switch boxes, conduits and kindred specialties. A New York producer has received an order for motors, controls and other electrical equipment for a steel mill extension in the Youngstown, Ohio, territory reported to cost $100,000. A metropolitan producer of pumping machinery has placed a contract for a quantity of induction motors for pump drives totaling $78,000.

Central stations continue to limit purchases to actual requirements. There are several heavy commitments anticipated, however, for new power station installations. A power company in Arizona has contracted with a New York manufacturer for a turbine unit and accessories to cost $30,000. A central station in Georgia has purchased a 60,000-kw. turbo-generator from an Eastern maker and has placed a quantity of business for the steam end with New York and Pennsylvania manufacturers. There is a fair call for substation apparatus, particularly from metropolitan utilities. A central New York power company has given an order for power transformers and miscellaneous switchgear to cost $35,000. Utility companies in South Jersey, Kentucky and West Virginia are also in the market for apparatus of this character. According to a maker of switching equipment, rotating bus switches are selling exceptionally well and record sales totals are developing.

A manufacturer of electric elevators reports business as very good, with a number of promising contracts pending. Electric refrigerator account is scoring new high production and sales records. A prominent maker reports orders shipped during the past 30 days as exceeding the corresponding period of last year by more than $1,000,000 in list price volume. The electric sign business is active and some record transactions are taking place. Floodlighting equipment for airport service shows no decline; present sales are satisfactory. Construction projects are as follows:

The New York Central Railroad Company, New York, will build electric locomotive and car shops at Harmon, N. Y., to cost $600,000. The Chevrolet Motor Company, Detroit, will make extensions in its assembling plant at Tarrytown, N. Y., to cost $3,500,000. The Bagley & Sewall Company, Watertown, N. Y., plans a power plant at its machinery plant to cost $75,000. Jamestown, N. Y., contemplates an addition to its municipal electric power plant to cost $85,000. The Borden Farm Products Company, New York, plans a bottling plant and distributing works at Mount Vernon, N. Y., to cost $400,000. The "Utica Observer Dispatch," Utica, N. Y., will build an addition to its printing plant to cost $80,000. Charles Pfizer & Company, Brooklyn, N. Y., will build a power house addition at its chemical plant to cost $130,000. The American Cyanamid Company, New York, contemplates a nitric acid plant near Johnson City, Tenn., to cost $500,000. The Public Service Electric & Gas Company, Newark, N. J., plans a power substation at Paterson, N. J. The Pennsylvania Railroad Company, New York, will build a cold storage plant at Jersey City, N. J., to cost $500,000. The Midwest Pipe & Supply Company, St. Louis, plans a branch plant at Clifton, N. J., to cost $85,000. Sears, Roebuck & Company, Chicago, will build a branch distributing plant at Philadelphia, to cost $100,000. The United Motors Service, Inc., Philadelphia, will build an automobile service and repair plant to cost $200,000. The Vick Chemical Company, Philadelphia, will build a plant unit to cost $100,000. Schuylkill Haven, Pa., plans a municipal power plant to cost $150,000. The Reading Railway, Philadelphia, plans a storage and distributing plant to cost $2,500,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., will build a refrigerating plant to cost $3,000,000. Frederick, Md., plans an ornamental lighting system. The Potomac Electric Power Company, Washington, plans an underground conduit system to cost $50,000. The General Purchasing Officer, Panama Canal, Washington, will receive bids until July 5 for panel boards, insulators, electric fixtures, cable and other electrical and mechanical equipment (Schedule 1970). More than $50,000 is being expended by the village of Penn Yan, N. Y., in improving and expanding facilities of the municipal light and power plant. The Board of Public Utilities, Jamestown, N. Y., has issued a call for bids for July 1, for the construction of an addition to the municipal light and power plant on Steele Street, to cost $60,000.

NEW ENGLAND DISTRICT

During the past week orders for small motors held level with the current trend in the New England district. One manufacturer notes several 50-hp. motor sales. The approximate total recorded by one company was $40,000 and for another manufacturer more than $8,000, including orders for control equipment of about $4,500. Heavy power equipment orders for a northern Maine water-power project will be placed soon. It is reported that additional equipment will be added to a western Massachusetts power company. New construction equipment is in good demand and outside line material is moving well. Orders totaling $20,000 for new line material for extension of systems in southern New Hampshire were placed recently. Special apparatus sales are encouraging. Recently a portable reflector unit for an airport costing $3,500 was ordered. Floodlighting is gaining in interest and orders are frequent.

Merchandising sales are strong, showing a substantial gain over last year. Construction projects are as follows:

The American Electro Metals Company, Lewiston, Me., plans additions to cost $200,000. The Holyoke Water Power Company, Holyoke, Mass., contemplates two hydroelectric power plants along its waterway at points near the Germania Mills, Inc., and the Franklin Paper Company. The Recording Tachometer Company, Worcester, Mass., plans a plant to cost $60,000. The New England Water, Light & Power Company, Providence, R. I., plans a hydroelectric power plant at East Hampton, Conn., to cost $250,000.

Middle West District

General business in the Middle West is entirely satisfactory. Steel operations are at about 90 per cent of normal. Car loadings show a substantial increase and railroad equipment purchasing is heavy. A great deal of circuit revision work has been going on. Interesting orders placed include 4,000 5-amp. watthour meters, 939 Thompson meters of 5 to 1,200 amp. capacity, 100,000 lb. of 40/60 wiping solder and ten carloads of transformer oil. Maintenance purchases are heavy, running at $115,000 per day. Construction projects are as follows:

The Rock River Canning Company, Fond du Lac, Wis., will make extensions in its plant to cost $100,000. Manitowoc, Wis., plans a municipal power plant to cost $400,000. The W. K. Kellogg Company, Battle Creek, Mich., will build an addition to its cereal mills to cost $900,000. The Evans Auto Loading Company, Detroit, plans an addition to its floor board plant on the Pacific Coast to cost $100,000. Lansing, Mich., plans an addition to its municipal power plant to cost $300,000. The Morton Salt Company, Chicago, plans an addition to cost $300,000. The National Parking Garages, Inc., Chicago, will build a service, repair and garage building to cost $2,500,000. The Ruth Automatic Garages, Inc., Chicago, will build a service, repair and garage building to cost $1,000,000. The Western Screw Manufacturing Company, Chicago, plans a plant to cost $150,000. The George D. Roper Corporation, Rockford, Ill., will take bids for an addition to its stove and range plant to cost $500,000. The Supreme Oil & Refining Company, Indianapolis, Ind., plans an oil refining plant to cost $100,000. The National Automatic Tool Company, Richmond, Ind., will build an addition to cost $85,000. The Firestone Battery Company, Akron, Ohio, will build a plant to cost $500,000. The Carthage Mills, Inc., Cincinnati, Ohio, plans a power plant to cost $40,000. The Columbus Power & Light Company, Columbus, Ohio, will build an addition to its power substation to cost $30,000. The Dayton Power & Light Company, Dayton, Ohio, plans a power plant to cost $1,000,000. The Quartermaster, Air Corps, Wright Field, Dayton, Ohio, contemplates an early call for bids for a power plant to cost $300,000. The McKay Machine Company, Youngstown, Ohio, will build an addition to cost $100,000. The Northwest Paper Company, Cloquet, Minn., plans extensions in its mill to cost $1,500,000. The Minnesota Mining & Manufacturing Company, Minneapolis, Minn., will build an addition to its abrasive material plant to cost $140,000. The Northland Transportation Company, Minneapolis, Minn., will build an automobile service and garage unit to cost $100,000. The Republic Creosoting Company, Minneapolis, Minn., plans an addition to cost $100,000.

Southeast District

There is no outstanding activity to be noted in central station or industrial lines, but the general volume of business is well sustained for the period of the year in the Southeast. One of the larger power companies is expected to place orders for switching equipment and transformers which will aggregate $350,000. An Alabama company ordered power transformers amounting to $35,000, while the Georgia Power Company ordered street-lighting equipment totaling $35,000 for the Atlanta "whiteway." Some other central-station orders were for poles and line hardware amounting to $5,700 and distribution and small power transformers totaling $4,200. A tire fabric manufacturing company in Georgia ordered a 2,000-kva. synchronous condenser, control equipment, switchboard and transformers aggregating $40,000 and a cotton mill in the same state ordered wiring and distribution materials amounting to $6,000 for a relighting project. A hotel in Atlanta placed an order for $6,000 in ceiling fans, while another hotel in that town recently ordered 200 desk fans. Construction projects are as follows:

The Chesapeake & Ohio Railroad Company, Richmond, Va., plans a power plant at its local shops to cost $50,000. The International Shirt Company, Bluefield, W. Va., plans a plant to cost $100,000. The American Cigar Company, Louisville, Ky., plans a plant to cost $2,000,000. The Southern Cities Power Company, Chattanooga, Tenn., will install an ornamental lighting system at Columbia, Tenn. The F. S. Royster Guano Company, Norfolk, Va., plans a fertilizer plant at Jackson, Miss., to cost $200,000. The River Falls Power Company, River Falls, Ala., plans a transmission line from Glenwood to Troy, Ala., and vicinity, with substation facilities. The Montevallo Cotton Mills, Montevallo, Ala., plan a mill to cost $100,000. The Mueller Company, Decatur, Ill., plans a brass pipe and plumbing equipment plant at Atlanta, Ga., to cost $100,000. The Certain-teed Products Company, St. Louis, plans a roofing and gypsum plant at Savannah, Ga., to cost $400,000.

St. Louis District

The feature of the present season's business in the St. Louis district has been the large volume of stock sizes of all apparatus which has been moved. This condition still continues and the rise in prices April 1 caused only a temporary slowing up. The only order of contract size reported was for two step-down transformers of 10,000 kva., three phase, to cost $30,000. These are to be used in connection with the Osage River hydro-electric development. Jobbers are now receiving a lot of belated fan orders and shipments of line and construction supplies are holding up in good quantity. Construction projects are as follows:

The Bird Stores, Inc., Kansas City, Mo., will build a baking and coffee roasting plant to cost $200.000. The Phillips Petroleum Company, Bartlesville, Okla., plans a gasoline refining plant at Wichita, Kan., to cost $150,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans an addition to the power plant at Alva, Okla., to cost $100,000. Oklahoma City, Okla., plans a floodlighting system for its municipal airport and other electrical equipment to cost $35,000. The Arkadelphia Gravel Company, Arkadelphia, Ark., plans a sand and gravel producing plant to cost $80,000. W. F. Moody, Little Rock, Ark., plans an electric light and power plant at Corning, Ark., to cost $40,000. Dermott, Ark., and Midland and Olney, Tex., plan ornamental lighting systems. The Baton Rouge Electric Company, Baton Rouge, La., contemplates a transmission line from Millerville to Denham Springs, La., and vicinity, to cost $50,000.

Pacific Coast District

Contractors are very busy on the Pacific Coast, especially in the Reno, Nev., and Sacramento, Calif., areas. Nevada business is better than for many years. Four large schools are being figured for Sacramento, Calif. Power company orders include $25,000 worth of sector cable for a steam station at Long Beach, Calif., one carload of crossarm braces, hardware, poles and cable for Boulder Creek, and many orders for construction tools for particular jobs. The city of San Francisco is considering proposals for a new city street-lighting system, several supervisors favoring the purchase from some local manufacturers, the city engineer recommending a centrifugally spun concrete pole. Westinghouse reports an oil well motor order for $15,000 for Torrance, Calif., and a 720-hp., 500-kva. synchronous motor-generator set for Tacoma, Wash., which with switching equipment figures $15,000. Hospital installations include Eureka, Palo Alto, Modesto and Santa Barbara, Calif., the last being an $800,000 building. Other projected construction includes a $25,000 fire alarm system for Santa Barbara, a $2,000,000 hotel for Long Beach, a $750,000 hotel for San Francisco and Eureka, a $2,000,000 addition for the pleasure plant at Aguascalientes in Mexico and a million dollar medical and dental building in Phoenix, Ariz.

Specifications are being written and the city of Seattle's municipal lighting department, through the Board of Public Works, during the next month will call for bids for constructing and equipping the first unit of the Diablo hydro-electric project, estimated to cost $2,700,000. Bremerton, Wash., voters authorized a bond issue of $750,000 to extend its municipal lighting system and a contract for constructing a cruiser for the U. S. Navy at the Bremerton navy yard virtually assured on a bid of $8,838,000. The construction of a $100,000 substation at the Minidoka dam is authorized by the Burley, Idaho, irrigation district. The larger motor awards made include between 50 and 60 machines, ranging from 5 to 150 hp., for the Fisher body plant in Seattle, seven from 75 hp. down for a lumber mill in eastern Oregon, twelve from 25 hp. down for a sawmill near Seattle and eight from 45 hp. down for a million dollar office building in

Seattle. One jobber reported the sale of $6,000 worth of machines to lumber mills and allied industrials, pulp and paper mills and dealers. The city of Seattle awarded a contract for weatherproof wire approximating $20,000. Construction projects are as follows:

The Adohr Creamery Company, Los Angeles, plans an addition to cost $200,000. Oakland, Calif., plans an ornamental lighting system. The Southern California Edison Company, Los Angeles, plans an addition to the power substation at Ojai, Calif., to cost $35,000. The Pacific Gas & Electric Company, San Francisco, will install an ornamental lighting system at Oroville, Calif. The Glidden Company of California, Inc., San Francisco, will build a paint and varnish plant to cost $175,000. The Mountain States Power Company, Tacoma, Wash., contemplates an addition to the power plant and transmission lines at North Bend, Ore., to cost $500,000. The Olympia Veneer Company, Olympia, Wash., will build a power plant at its mill to cost $50,000. The Firestone Tire & Rubber Company, Akron, Ohio, will build a factory branch and distributing plant at Seattle, Wash., to cost $250,000. Buhl, Idaho, will receive bids until July 9 for an electric distributing system. The Goodyear Tire & Rubber Company, Akron, Ohio, will build a factory branch and distributing plant at Salt Lake City, Utah, to cost $80,000. The Oliver Mining Company, Paonia, Colo., will build an addition to cost $100,000.

Activities of the Trade

Fifty per Cent Increase in Sales by Western Electric

The Western Electric Company sales for the first five months of 1929 totaled $160,600,000, an increase of $54,000,000, or practically 50 per cent over the same period last year. Sales for the month of May were the largest of any single month in the company's history, amounting to $37,326,000.

"The constantly increasing demand for telephone facilities has made necessary a large expansion program in the company's various manufacturing units," said Edgar S. Bloom, president of the company. "At the present time buildings either under construction or contracted for will give an additional 2,000,000 sq.ft. of floor area for manufacturing purposes."

Electric Firm Changes

The Commercial Electrical Supply Company, 366 Madison Avenue, Memphis, Tenn., will be operated as a division of the Westinghouse Electric Supply Company, according to an announcement made by W. F. Cleveland, manager. The Westinghouse Electric Supply Company is a subsidiary of the Westinghouse Electric & Manufacturing Company. The Commercial Electrical Supply Company acts as wholesale dealer in Westinghouse products for the entire Memphis territory.

THE GRINNELL WASHING MACHINE CORPORATION, Grinnell, Iowa, announces that it has placed on the market a new ironing machine known as the "Princess" ironer.

THE CENTURY ELECTRIC COMPANY, St. Louis, manufacturer of alternating-current motors and fans, has purchased Roth Brothers & Company of Chicago, manufacturer of direct-current industrial power motors, direct-current generators for industrial power and lighting, alternating-current generators, motor-generator sets for moving picture projectors, broadcasting, television, battery charging, signal systems and other specialties. While Roth Brothers & Company will be operated as a division of the Century Electric Company, some of these items will now be manufactured in the Century company's plant.

PASS & SEYMOUR, INC., Solvay Station, N. Y., manufacturer of porcelain and electrical supplies, announces that on and after July 1 its Chicago office, warehouse and showroom will be located at 605 West Washington Street.

THE JOHNS-MANVILLE CORPORATION, 292 Madison Avenue, New York City, announces the removal of its Milwaukee sales office to the Railway Exchange Building, 97 East Wisconsin Avenue.

THE ARMSTRONG ELECTRIC & MANUFACTURING CORPORATION, Huntington, W. Va., manufacturer of electrical specialties and hardware, announces the appointment of C. M. Bunnell as its general sales manager with executive and general sales offices at 522 Fifth Avenue, New York City. Mr. Bunnell was formerly general sales manager of the Pyrene Manufacturing Company, Newark, N. J.

THE DELTA-STAR ELECTRIC COMPANY, 2400 Block, Fulton Street, Chicago, manufacturer of high-tension equipment, announces the purchase of the buildings and equipment of the Howard foundry and pattern shops, with which will be combined the present Delta-Star foundry. This addition will insure adequate production of copper, aluminum, manganese bronze and brass castings.

Westinghouse Agent-Jobbers Hold Annual Meeting

THE Westinghouse Agent-Jobbers' Association held its seventeenth annual meeting on June 10 to 15, inclusive, at the Homestead, Hot Sprigs, Va. Reports of a number of committees, an address by Dr. H. P. Baker, manager of the trade association department, Chamber of Commerce of the United States of America; the election of officers and members to serve on the executive committee during the ensuing year and a farewell party for J. S. Tritle, formerly general manager of the merchandising department of the Westinghouse Electric & Manufacturing Company, who was recently elected vice-president in charge of manufacturing of the Westinghouse company, were features of the meeting.

Karr Parker, treasurer and engineering manager of McCarthy Brothers & Ford, Buffalo, N. Y., was elected president and E. D. Kilburn, vice-president and general sales manager Westinghouse Electric & Manufacturing Company, was elected vice-president. H. M. Gansman, vice-president of the H. C. Roberts Electric Supply Company, Philadelphia, was elected secretary and H. T. Pritchard of the merchandising department of the Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, was elected assistant secretary and treasurer. The following were elected members of the executive committee: A. E. Allen, vice-president Westinghouse Lamp Company, New York; Samuel Adams Chase, special representative Westinghouse Electric & Manufacturing Company, Mansfield, Ohio; W. I. Bickford, president Iron City Electric Company, Pittsburgh; B. E. Finucane, general manager Rochester Electric Supply Company, Rochester, N. Y.; W. W. French, vice-president and general manager Moore Handley Hardware Company, Birmingham, Ala.; M. C. Morrow, sales manager merchandising department, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio; T. J. Pace, director of sales Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; J. C. Schmidtbauer, president Julius Andrae & Sons Company, Milwaukee, Wis.; C. E. Stephens, Northeastern manager Westinghouse Electric & Manufacturing Company, New York; N. G. Symonds, Northwestern manager Westinghouse Electric & Manufacturing Company, Chicago, and Walter Williamson, vice-president and general manager Alpha Electric Company, New York.

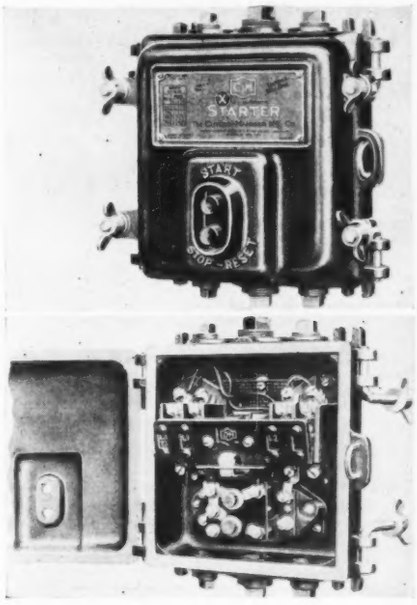
THE WAGNER ELECTRIC CORPORATION, St. Louis, announces that it has moved its Buffalo, N. Y., service station and branch sales office to a new building at 1796 Main Street.

THE FRIGIDAIRE CORPORATION, Dayton, Ohio, has appointed J. L. Conover, formerly branch manager of the Minneapolis district, as Pacific Coast manager for the company. Mr. Conover will maintain his headquarters at 513 Ray Building, Oakland, Calif.

New Equipment Available

Dust-Tight Inclosures for Cutler-Hammer Starters

The development of dust-tight inclosing cases for their across-the-line automatic starters is announced by Cutler-Hammer, Inc., Milwaukee, Wis. These new inclosures are built in two types: For motors up to 5 hp. the case is of cast iron and for larger sizes is made of heavy welded boiler plate. They are provided with a soft para rubber gasket between the cover and case. Eyebolts with wing nuts at the sides hold the cover tight. In addition to being dust-tight, the small cast-iron inclosure is also weatherproof. It has the start, stop and reset buttons mounted directly



in the cover. The larger sizes have the reset button only in the cover and a separate dust-tight push-button station provides remote control.

The new dust-tight equipment will not replace the Cutler-Hammer standard dustproof inclosures, but is to be offered as an option for installation in mines, woodworking plants, cement mills, flour mills, pulverizing plants and other industries where a large amount of dust in the air may interfere with the efficient operation of the starter.

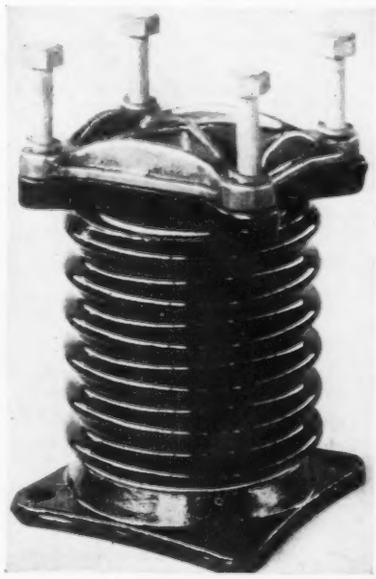
Vertical Capstan Reduces Space Needs

For moving freight cars and barges in industrial plants the Lidgerwood Manufacturing Company, Elizabeth, N. J., is marketing a new vertical capstan known as the "Tugmore." Compactness has been emphasized in the design, reducing the space requirements to 25x34 in. It is claimed that with the installation of a "Tugmore" capstan

continuous loading or unloading may be maintained without the necessity of assigning a crew of men to shift cars by hand. The "Tugmore" has been made a standard type and is available from stock in five sizes, 5 and 7½ hp. alternating current, 5 and 7½ hp. direct current and 6 to 8 hp. twin-cylinder air-cooled motor using gasoline or kerosene for fuel. Capstans are frequently installed in exposed locations and the adoption of the air-cooled motor to drive the capstan is important as the freezing hazard is avoided. Three types of anti-friction bearings running in oil are used in the "Tugmore" and both electric and gasoline types are of weathertight construction.

Heavy-Duty Bus Supports for Indoor Service

A new and improved line of heavy duty bus supports for indoor service up to and including 25 kv. is announced by the Champion Switch Company, Kenova, W. Va. The porcelain units are furnished in diameters of 4 in., 5 in. and 6¼ in. The bases are for flat or pipe

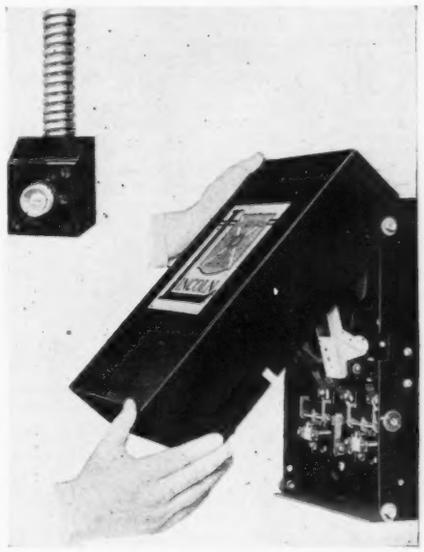


mounting and the clamps are for round or flat bus.

These insulators interchange with those used on heavy-duty single and multiple pole disconnecting switches.

Across-the-Line Safety Starter

An improved starter which starts a motor directly across the line has been recently placed on the market by the Lincoln Electric Company, Cleveland, Ohio. The starter is controlled by the new Lincoln safety push button, which is standard equipment with the across-the-line starter. Ease of installation, extreme accessibility to all operating parts and rugged construction are some of the advantages claimed for the new starter. Its installation is extremely simple, only four screws being used to hold the starter in place. Releasing two other screws permits the contactor panel to swing out, thus making lead contacts



easily accessible. A cover of the drop hinge type incloses the entire mechanism and permits installation of starters closely grouped, 2-in. clearance between the starter boxes being ample for easy accessibility.

It is stated that long life is assured to contact points by the wiping action, which prevents pitting, and by the cadmium plated steel shields, which provide an instantaneous thermal and magnetic quench for the arcs. Arc chimneys are of heavy pressed magnesite which shield against currents higher than any to which the starter will ever be subjected. The relay armature has a cushion action which reduces wear and insures long life. Likewise, it is provided with replaceable bronze bearings and is actuated by a coiled spring.

The Lincoln safety push button provides an additional safety factor to the Lincoln across-the-line safety starter in that the red stop button encircles and protects the green start button so that it is impossible to close the starting circuit unintentionally. The safety push button can be mounted on the side of the starter box or arranged for remote control.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 4, 1929)

1,716,167. APPARATUS FOR AND METHOD OF ALIGNING ELEMENTS IN SEALED CONTAINERS; J. C. Grogan, Brooklyn, N. Y. App. filed May 18, 1925.

1,716,179. UTENSIL FOR COOKING RANGES; M. Mack, New Brunswick, N. J. App. filed Nov. 8, 1928.

1,716,182. ELECTRIC MOTOR; M. L. Plummer, Johnstown, Pa. App. filed May 19, 1926.

1,716,203. ELECTRICALLY-HEATED MACHINE FOR THE BREWING OF TEA, COFFEE, AND LIKE BEVERAGES; A. G. Barrow, Roundhay, England. App. filed June 7, 1928.

1,716,246. METER-TESTING BLOCK; H. F. Sparkes, Pittsburgh, Pa. App. filed April 15, 1926.

1,716,271. STREET-LIGHTING SYSTEM; S. B. Hood, Minneapolis, Minn. App. filed Aug. 2, 1924.

1,716,292. BATTERY-CHARGING SYSTEM; E. J. Blake, Buffalo, N. Y. App. filed Sept. 2, 1925.

1,716,320. STORAGE-BATTERY PLATE AND PROCESS OF MAKING SAME; L. J. Pearson, Wyncote, Pa. App. filed May 22, 1920.

1,716,326. ELECTRIC CONNECTER; E. J. Schlatter, Brooklyn, N. Y. App. filed June 8, 1926.

1,716,329. COMBINATION ELECTRIC AND GAS STOVE; W. Simpson, Blissfield, Mich. App. filed July 11, 1928.

1,716,350. GLASS MOLD; B. Bart, East Orange, N. J. App. filed Nov. 10, 1923.

1,716,357. ELECTROMAGNETIC RELAY; J. Erickson, Chicago, Ill. App. filed June 17, 1921.

(Issued June 11, 1929)

Reissue 17,323. PROCESS OF FACING THE CUTTING EDGES OF DRILLING TOOLS; R. D. Davies, Huntington Park, Calif. App. filed Oct. 1, 1928.

1,716,389. ELECTRICAL APPARATUS; F. F. Starr, Dayton, Ohio. App. filed March 12, 1924.

1,716,442. ELECTRIC WELDING MACHINE; L. H. Hoffer, Brooklyn, N. Y. App. filed April 10, 1924.

1,716,461. GALVANIC BATTERY; F. C. F. Portail, Gennevilliers, France. App. filed June 14, 1927.

1,716,494. SYNCHRONOUS ROTATING-FIELD COMMUTATOR MACHINE; J. Jonas Baden, Switzerland. App. filed July 16, 1926.

1,716,553. TRANSFORMER; R. P. Higbee, Edgewood, Pa. App. filed July 10, 1926.

1,716,580. HAIR DRIER; F. X. A. Duhamel, Ottawa, Ont., Can. App. filed June 12, 1928.

1,716,587. CONDUIT FITTING; D. E. Kellogg, Erie, Pa. App. filed Oct. 24, 1925.

1,716,590. NON-FERROUS WELDING ROD; A. R. Lytle, Elmhurst, N. Y. App. filed Dec. 6, 1927.

1,716,610. STORAGE BATTERY; H. D. Wilson and A. L. Hopkins, Indianapolis, Ind. App. filed Jan. 2, 1925.

1,716,614. ELECTRIC WELDING; S. R. Bergman, Nahant, Mass. App. filed Aug. 4, 1925.

1,716,641. CONDUIT FITTING; D. E. Kellogg, Erie, Pa. App. filed Sept. 26, 1925.

1,716,646. SWITCH; A. F. C. Lotz, Chicago, Ill. App. filed May 19, 1924.

1,716,660. METER ADAPTER; G. E. Palmer, Brookline, and E. G. Johnson, Boston, Mass. App. filed Sept. 15, 1923.

1,716,700. ELECTROSCOPE; R. D. Kleeman, Schenectady, N. Y. App. filed July 9, 1926.

1,716,723. COMBINED ADVERTISING AND STATION-INDICATING DEVICE; J. A. Greer, Neponset, and C. M. Greer, Elmhurst, Ill. App. filed Oct. 8, 1926.

1,716,731. CONDENSER; J. L. Merrill, Media, Pa. App. filed July 5, 1924.

1,716,752. CONTROL SYSTEM; E. Austin, Schenectady, N. Y. App. filed Feb. 2, 1923.

1,716,777. ALTERNATING-CURRENT CONVERTER; N. M. Hopkins, New York, N. Y. App. filed March 7, 1922.

1,716,789. METHOD OF AND MEANS FOR CONTROLLING RECIPROCATING MOTORS; E. J. Missien, Pittsburgh, Pa. App. filed March 5, 1924.

1,716,791. ELECTRICAL AIR CONDITIONING AND CIRCULATING DEVICE; W. H. C. Ness, Los Angeles, Calif. App. filed Nov. 28, 1928.

1,716,798. ARRANGEMENT FOR PREVENTION OF REVERSE CURRENT IN BATTERY CHARGERS; K. Schmidt, Berlin-Lichtenrade, Germany. App. filed Jan. 9, 1928.

1,716,808. ELECTROMAGNETIC DEVICE; H. A. Wallace, Edgewood Borough, Pa. App. filed April 30, 1926.

1,716,811. MUSIC-RECORDING INSTRUMENT; H. P. Ball, New York, N. Y. App. filed Feb. 5, 1924.

1,716,834. ELECTRICAL RECEPTACLE; W. H. Nichols, Bennington, Vt. App. filed Feb. 12, 1924.

1,716,884. FUSE; J. H. Goss, Waterbury, Conn. App. filed Nov. 13, 1925.

1,716,895. IGNITION SYSTEM; M. Mallory, Toledo, Ohio. App. filed Feb. 6, 1928.

1,716,912. INCANDESCANT ELECTRIC LAMP AND PROCESS OF PRODUCING THE SAME; A. L. Becket, East Orange, N. J. App. filed Nov. 11, 1925.

1,716,951. ELECTRIC SWITCH AND MEANS FOR OPERATING SAME; F. S. Denison, Minneapolis, Minn. App. filed Aug. 7, 1922.

1,716,963. INSULATOR; R. M. Johnston, Huntington, W. Va. App. filed March 26, 1920.

1,716,987. ELECTRIC SWITCH; A. G. Steinmayer, Milwaukee, Wis. App. filed Aug. 13, 1925.

1,716,996. ELECTRIC WATER HEATER; M. M. Adam, Washington, D. C. App. filed June 16, 1928.

1,716,998. DOOR-OPERATED SWITCH; J. E. Beauchamp, Montreal, Que., Can. App. filed March 12, 1928.

1,717,040. ELECTRICAL VAPORIZER; J. Kaufman and M. Zaiman Brooklyn, N. Y. App. filed July 27, 1928.

1,717,057. ELECTRIC SWITCH; G. J. Meuer, Milwaukee, Wis. App. filed March 11, 1925.

1,717,070. RECTIFYING SYSTEM; H. O. Siegmund, Springfield, N. J. App. filed Nov. 1, 1921.

1,717,095. POTENTIAL-LIMITING DEVICE; A. A. Clokey, Rutherford, N. J. App. filed March 22, 1926.

1,717,132. ELECTRIC BOTTLE WARMER; W. L. Weinmann, San Francisco, Calif. App. filed April 23, 1927.

1,717,145. MOUNTING FOR ARMATURES; B. L. Conley, St. Louis, Mo. App. filed Nov. 18, 1927.

1,717,155. THERMOSTATIC CONTROL FOR ELECTRIC HEATERS; L. P. Hynes, Albany, N. Y. App. filed Aug. 29, 1923.

1,717,162. INTERNAL-COMBUSTION ENGINE; H. E. McCray, Waterloo, Ia. App. filed Feb. 15, 1923.

1,717,171. PLASTIC CONDUCTIVE COMPOSITION; A. W. Schorger, Madison, Wis. App. filed Aug. 12, 1927.

1,717,191. TIME-ELEMENT ELECTRORESPONSIVE DEVICE; M. Crémer, Paris, France. App. filed Aug. 15, 1925.

1,717,199, 1,717,200. MAGNETIC CORE; J. J. Frank, Pittsfield, Mass. Apps. filed Aug. 23 and Sept. 4, 1928.

1,717,207. ELECTRIC WATER HEATER; S. Halle, Colorado Springs, Colo. App. filed Dec. 28, 1927.

1,717,210. HIGH-VOLTAGE CIRCUIT INTERRUPTER; E. M. Hewlett, Schenectady, N. Y. App. filed Aug. 16, 1928.

1,717,211. SYSTEM OF DISTRIBUTION; E. M. Hewlett, Schenectady, N. Y. App. filed June 1, 1927.

1,717,214. RESILIENT WHEEL; F. B. Howell, Schenectady, N. Y. App. filed March 29, 1924.

1,717,216. TEMPERATURE INDICATOR; A. C. T. Isaac, Pittsfield, Mass. App. filed Sept. 18, 1928.

1,717,219. STEP-BACK MOTOR-CONTROL SYSTEM; B. W. Jones, Schenectady, N. Y. App. filed Nov. 1, 1926.

1,717,240. PROTECTIVE ARRANGEMENT; S. Miki, Tokyo, Japan. App. filed Sept. 21, 1927.

1,717,243. APPARATUS FOR WINDING ELECTRIC CONDENSERS; G. Nauk, Berlin, Germany. App. filed Dec. 18, 1925.

1,717,247. ELIMINATION OF CHATTERING OF HUM IN ALTERNATING-CURRENT ELECTROMAGNETS; C. L. Perry, Schenectady, N. Y. App. filed July 10, 1925.

1,717,255, 1,717,256. SHIP PROPULSION; A. A. Pollock, Leamington Spa, England. Apps. filed July 17, 1923.

1,717,260. CIRCUIT INTERRUPTER; W. K. Rankin, Schenectady, N. Y. App. filed Sept. 14, 1921.

1,717,264. CONTROL SYSTEM; W. H. Rowney, Schenectady, N. Y. App. filed July 7, 1926.

1,717,265. THERMIONIC APPARATUS; A. Schmidt, Jr., Schenectady, N. Y. App. filed July 19, 1927.

1,717,269, 1,717,270. ELECTRIC COOKING DEVICE; J. L. Schroyer, Oak Park, Ill. Apps. filed May 6, 1925 and March 25, 1927.

1,717,280. PRESSURE-MEASURING INSTRUMENT; J. W. Thompson, Schenectady, N. Y. App. filed Dec. 28, 1927.

1,717,281. INSULATOR; E. Thomson, Swampscott, Mass. App. filed March 2, 1927.

1,717,283. INCANDESCENT ELECTRIC LAMP; I. H. Van Horn and W. A. Pipkin, East Cleveland, Ohio. App. filed Dec. 8, 1925.

New Trade Literature

TACHOMETERS AND GROUND RESISTANCE TESTER.—James G. Biddle, 1211 Arch Street, Philadelphia, is distributing catalog No. 1240, describing and illustrating the "Frahm" vibrating-reed tachometers, and bulletin No. 1245, entitled "Who's Who in Ground Testing" and "what they say" about the "Megger" ground resistance tester.

CABINETS.—Bulletin No. 42 issued by the Wadsworth Electric Manufacturing Company, Inc., Covington, Ky., covers the new Wadsworth line of 60-amp. range circuit cabinets with or without plug fuse distribution for flush and surface mounting.

HOIST.—Bulletin No. 91C issued by the Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., describes the new "Red Giant" silent chain motor driven type of hoist, model M, which can be installed on any type of base, hinged or telescope frame or with any style of platform. The combination of frames, bases, hoist and platforms also are discussed and illustrated.

DIESEL ENGINES.—The Busch-Sulzer Brothers Diesel Engine Company, St. Louis, is distributing form No. 796 covering its four-cycle, type F Diesel engine for heavy-duty, stationary service, marine direct drive and marine electric drive.

RECORDING VOLTMETERS AND AMMETERS.—Bulletin No. 373 issued by the Bristol Company, Waterbury, Conn., describes and illustrates its new small size recording voltmeters and ammeters.

FIRST AID MATERIALS.—The Mine Safety Appliances Company, Braddock Avenue and Thomas Boulevard, Pittsburgh, is distributing catalog No. FA-1 containing descriptions, illustrations, prices, etc., of its M-S-A first aid materials.

CONNECTORS.—A catalog issued by the Penn-Union Electric Corporation, Erie, Pa., covers the Penn-Union solderless connectors. Tables containing a complete line, including the right type and size of solderless connectors for all standard requirements, list prices, etc., are included.

ELECTRIC FURNACES.—The Electric Furnace Company, Salem, Ohio, has issued a booklet which lists some of the products being heat-treated in its electric furnaces and shows furnaces of various types designed for handling these products.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Montreal, Canada (No. 38,962), for household electrical appliances.

An agency is desired in Athens, Greece (No. 38,960), for household electrical appliances, switches, meters, wire and lamp adapters.

An agency is desired in Penang, Straits Settlements (No. 38,961), for incandescent lamps and lighting fixtures.

An agency is desired in Vancouver, Canada (No. 38,963), for floor and table lamps.

Purchase or agency is desired in Regina, Canada (No. 39,061), for lighting fixtures, wiring materials, incandescent lamps, etc., and another (No. 39,065), for telephone equipment.

Purchase is desired in Kingston, Canada (No. 39,063), of a 600-kw. motor-generator set and a 2,000 lb. capacity electric steel furnace.

An agency is desired in Alexandria, Egypt (No. 38,964), for electrical wiring supplies.